

CALIFORNIA ACADEMY OF SCIENCES

MEMBER PUBLICATION

WINTER 2006



Trap-jaw Ants
Ivory-Billed Investigation
Aquarium Construction 101
Summer Systematics Institute

Winter weather is on the way, and the Academy is ready to greet the season. Out in Golden Gate Park, contractors have just finished pouring the roof deck on the new Academy building, protecting the dry wall and insulation below from the impending winter rains. Unlike most insulation, which is made from fiberglass, the insulation for the new Academy was manufactured from recycled blue jeans and contains 85% post-industrial recycled content. This is just one of the many sustainable construction strategies that will make the new Academy one of the greenest public buildings in the country when it opens in late 2008. (To read more about progress on the new Academy, turn to pages 5 and 24.)



Meanwhile, here at Howard Street, we are busy creating a wide range of rainy day activities for our visitors. Until February 4, the popular *DINOSAURS: Ancient Fossils, New Discoveries* exhibit will continue to offer opportunities for dino enthusiasts to explore the most recent finds in field, including some of the famous feathered dinosaur fossils from China. Once the exhibit closes, the space that was formerly home to tyrannosaurs and mechanical models will slowly be filled by additional aquarium tanks. These tanks will hold some of the new fish, amphibians, and reptiles that will eventually make their way into the new Academy exhibits in Golden Gate Park.

During the construction of the new aquarium space, we will be offering an expanded suite of public programs, including a two-week celebration of the Chinese Lunar New Year, regular meet-the-biologist sessions, and portable planetarium shows. Standard favorites including penguin feedings, snake feedings, and coral reef dives will also continue to be offered. A complete calendar of events is available on pages 8-13.

As we have tested different types of programming over the past several years, we have learned that some of the best experiences we can create for our visitors involve the opportunity to interact with an Academy scientist or volunteer. Thus, as the opening date of the new Academy draws nearer, we are beginning to train a corps of docents and volunteers who will be an integral part of the new Academy experience. If you have thought about volunteering for the Academy in the past, there has never been a better time to start (see page 17 for details). In the meantime, I hope you will take advantage of our special offerings here at Howard Street. We look forward to seeing you soon.

- Patrick Kociolek, Executive Director

- 3 Academy Research**
Move Aside, Mantis Shrimp
The Trap-Jaw Ant is the new King of Speed
- 5 Aquarium News**
Super-Size It *What does it take to build an aquarium tank that holds over 200,000 gallons of water?*
- 6 Programs/Highlights**
- 7 Lectures**
- 8 Calendar**
- 14 Academy Research**
Birds of a Feather? *Through DNA testing, Academy ornithologist Jack Dumbacher has found that some birds previously assigned the same name are actually separate species.*
- 16 Sky Guide**
- 17 Docents' Corner**
- 18 Travel Program**
- 19 Lectures (continued)**
- 20 Education**
Summer Systematics Institute
Academy research program for undergraduates wraps up its 12th year
- 22 Development**
- 24 New Academy Update**

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Move Aside, Mantis Shrimp

The Trap-Jaw Ant is the New King of Speed

A trap-jaw ant (*Odontomachus bauri*) stalks a young cricket.

Photo by: Alex Wild.

A new record has just been set in the category of fastest self-powered strike—and it doesn't belong to a cheetah, a lizard tongue, or a Nolan Ryan fast ball. According to new research by Academy entomologist Brian Fisher, trap-jaw ants in the species *Odontomachus bauri* can make all three of these speed demons seem sluggish by moving their mandibles at speeds of up to 64 meters per second, or 145 miles per hour. These remarkably rapid movements help them to capture prey, eject enemies, and catapult themselves to safety.

Fisher first encountered the phenomenally fast ants in October of 2004 at La Selva Biological Station in Costa Rica, where he was collecting a colony of army ants for the Academy's exhibit, *ANTS: Hidden Worlds Revealed*. "I traveled to Costa Rica to study army ants, which build nests out of their own bodies and are fascinating in their own right," says Fisher, who has collected over 900 new species of ants during his career. "But these trap-jaw ants really stole the show. Their strike is so quick that

you can't actually see their jaws move, but as their mandibles make contact with another surface, you can hear this clicking sound, and the aftermath is hard to miss—the ants can literally send themselves somersaulting through the air." Intrigued by this behavior, Fisher collected several dozen trap-jaw ants and brought them back to California, where he worked with Sheila Patek from the University of California, Berkeley and Andrew Suarez from the University of Illinois to study the speedy insects.

The team used a high-speed video camera filming at 50,000 frames per second to visualize the ants' mandible movements. Motion pictures, by comparison, are typically shot at 24 frames per second. The average duration of a trap-jaw mandible strike was a mere 0.13 milliseconds, or over 2,000 times faster than the blink of an eye. "Ants are similar to human societies in many ways, but they have mastered rapid motion in a way we never can," says Fisher. "Without the invention of the new technology used in the high speed camera, we never

would have discovered this fast world of ballistic jaw propulsion."

The Need For Speed

Trap-jaw ants are able to achieve unprecedented strike speeds by utilizing a latch system to release stored energy. Their mandibles are held in a cocked position by a pair of large, contracting muscles in the head. The muscles are sprung when their corresponding latches are triggered. These rapid motions do not simply help the ants capture prey; the extreme accelerations also create strike forces that can exceed 500 times the ant's body weight, allowing the ants to launch themselves into the air. Simply by snapping their jaws against the ground or the body of an intruder, the ants can catapult themselves out of harm's way, achieving heights of up to 8.3 centimeters and horizontal distances of up to 39.6 centimeters. If an average human were to travel along a comparable aerial trajectory, these numbers would translate to roughly 44 feet high and 132 feet long.

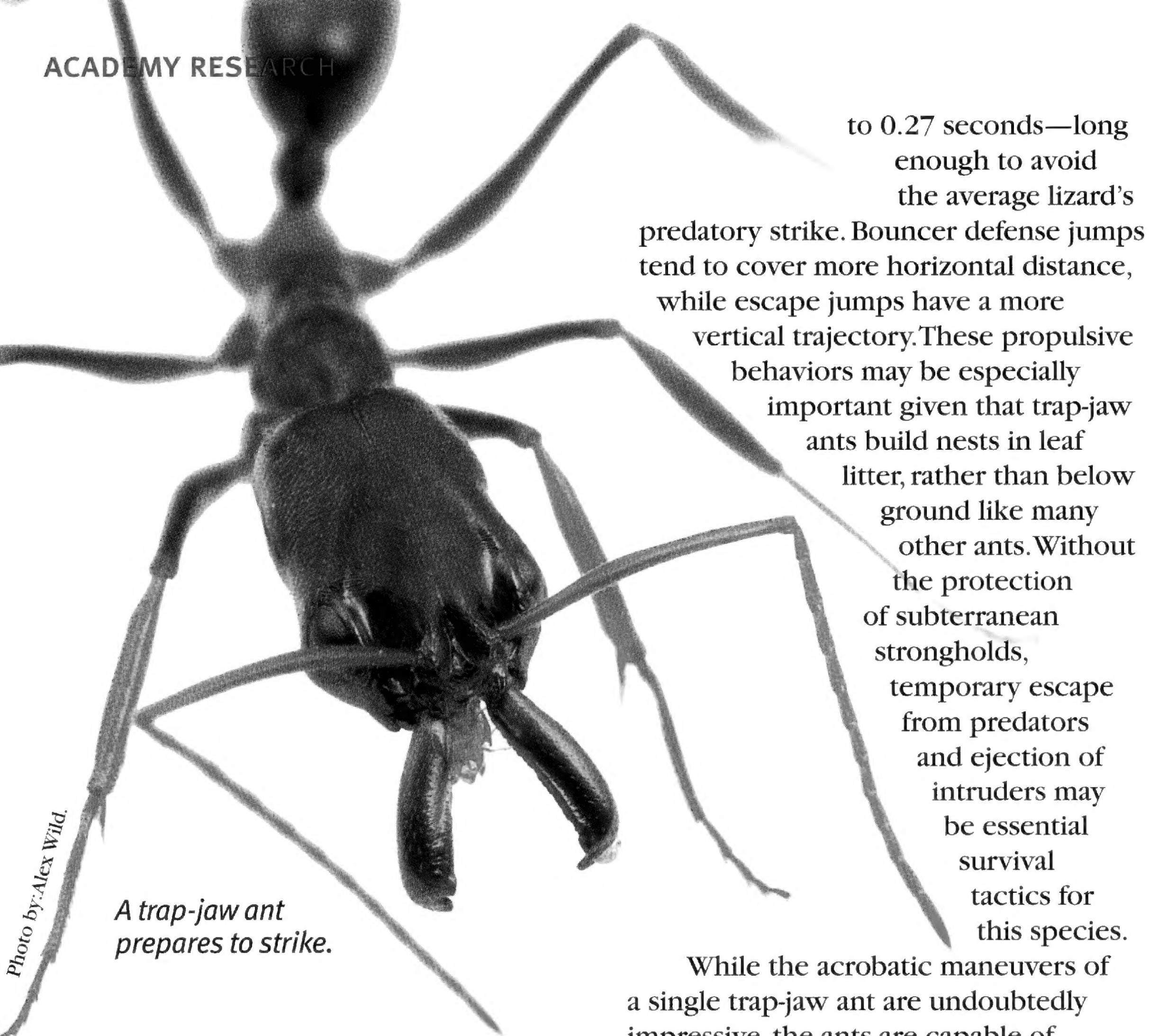


Photo by: Alex Wild.

A trap-jaw ant prepares to strike.

Fisher and his colleagues identified two different types of defensive propulsion among trap-jaw ants: “bouncer defense” strikes and “escape jump” strikes. In a bouncer defense strike, an ant swipes a large intruding object with its jaws, simultaneously propelling itself away from the intruder. In an escape jump, the ant fires its mandibles directly against the ground, launching itself into the air and remaining airborne for up

to 0.27 seconds—long enough to avoid the average lizard’s predatory strike. Bouncer defense jumps tend to cover more horizontal distance, while escape jumps have a more vertical trajectory. These propulsive behaviors may be especially important given that trap-jaw ants build nests in leaf litter, rather than below ground like many other ants. Without the protection of subterranean strongholds, temporary escape from predators and ejection of intruders may be essential survival tactics for this species.

While the acrobatic maneuvers of a single trap-jaw ant are undoubtedly impressive, the ants are capable of choreographing even more astounding routines when they work together as a team. “The first time I saw a colony of trap-jaw ants demonstrate cooperative striking behavior, I was amazed,” says Fisher. “A group of ants can confuse predators by performing multiple, simultaneous escape jumps, creating what I call the ‘popcorn effect.’ The ants can also team up to perform group bouncer defense attacks on large intruders.”

How does such a complex set of behaviors evolve? Fisher and his colleagues believe that the trap-jaw system in *O. bauri* ants probably originally evolved simply for high-speed predatory strikes, allowing them to capture quick insects like springtails. The extreme force generated by these high-speed strikes was likely just a side effect that turned out to be highly beneficial for the ants, since it provided great propulsion potential.

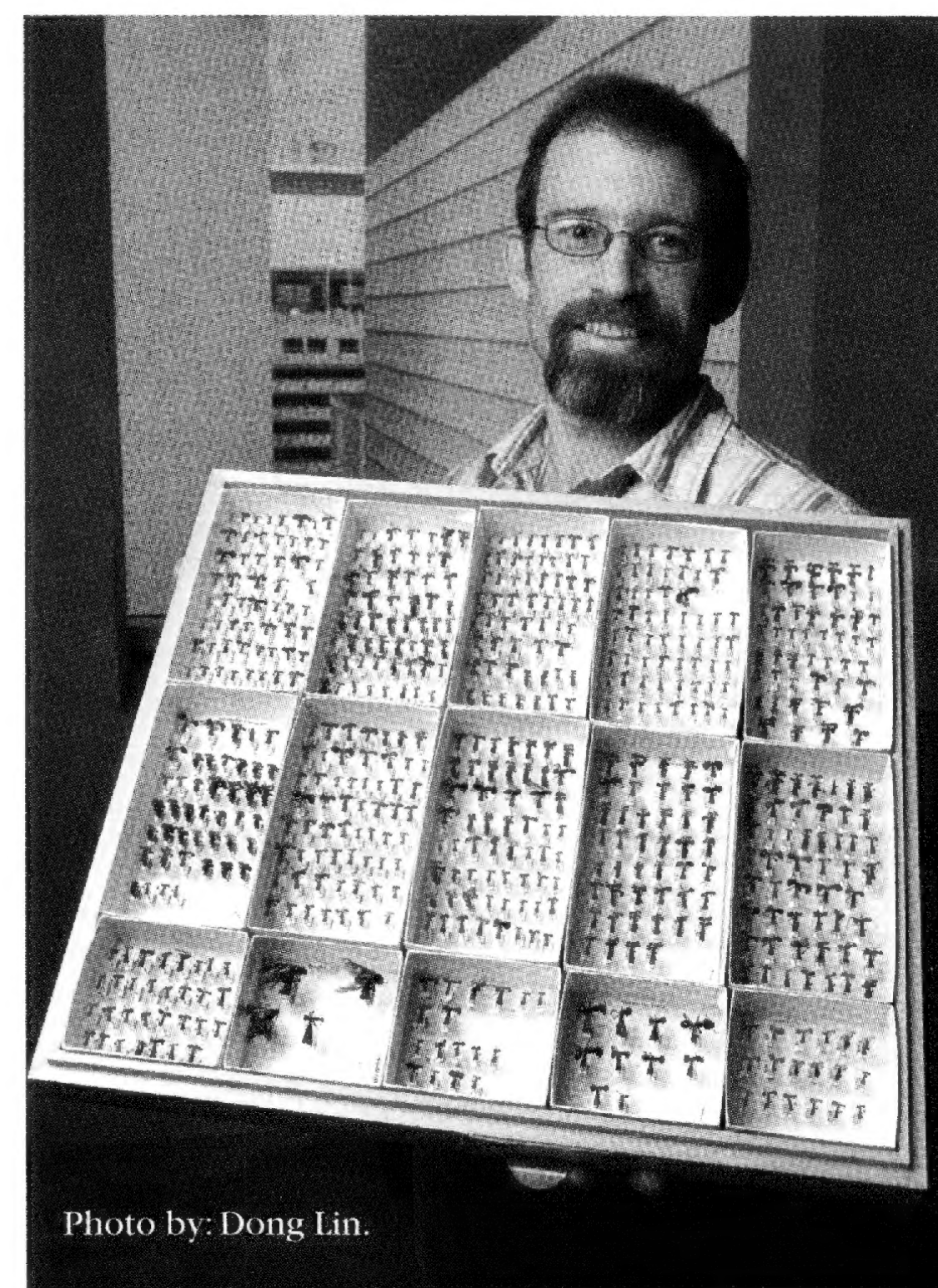
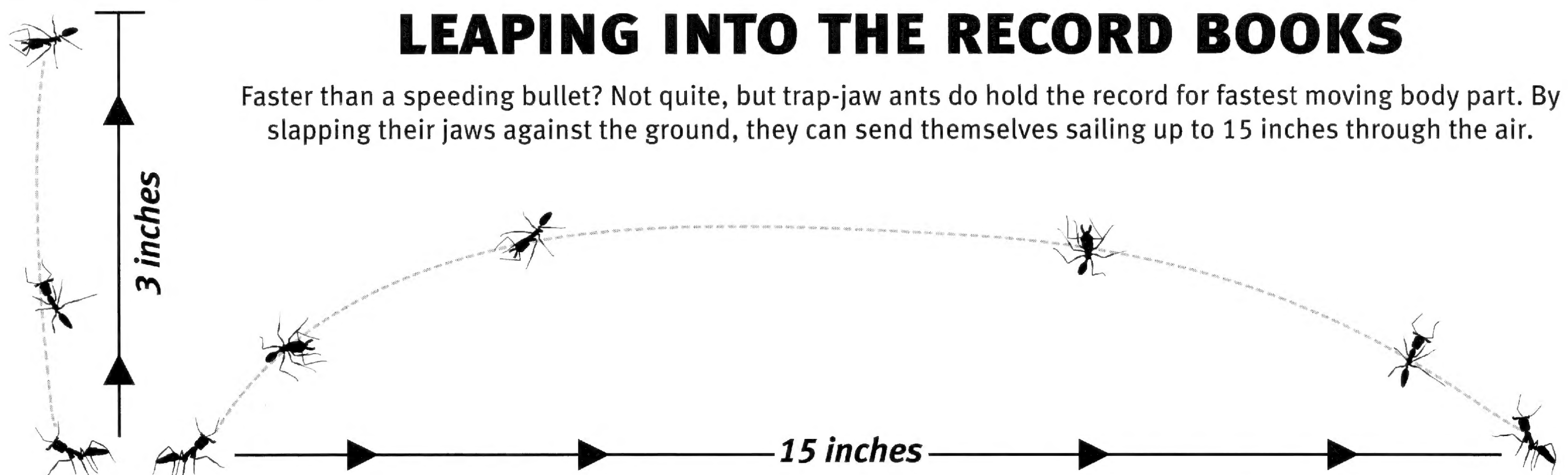


Photo by: Dong Lin.

Academy entomologist Dr. Brian Fisher is currently studying trap-jaw behaviors in other species of long-mandibled ants, many of which occur in Madagascar.

LEAPING INTO THE RECORD BOOKS

Faster than a speeding bullet? Not quite, but trap-jaw ants do hold the record for fastest moving body part. By slapping their jaws against the ground, they can send themselves sailing up to 15 inches through the air.



RUNNERS-UP



If trap-jaw ants take the gold medal for the fastest moving body part in the animal kingdom, who stands below them on the podium? Mantis shrimp, the previous record-holders, can strike at 23 meters per second, while jellyfish can eject stinging spines called stylets at 18.6 meters per second.

In late 2008, the new Academy will open to the public in Golden Gate Park, allowing visitors to witness the beauty of a 25-foot-deep living coral reef display for the very first time. What they will see as they gaze into the 212,000-gallon tank will surely inspire awe, but what they will not see—the process of building the tank—is equally impressive.

The Academy's architectural team, led by Pritzker Prize winner Renzo Piano, designed the massive tank to include a series of curved walls in order to maximize visual interest. Constructing the wooden formwork for the concrete walls of the tank therefore presented a sizeable challenge. Rather than using standard rectangular formwork reinforced with aluminum braces, carpenters had to create complex curves with custom bracing from scratch, carefully following the unusual geometry of the tank. The formwork also had to accommodate five precise openings for the acrylic viewing panels; holes that were slightly too small would prevent the windows from sliding into place, and holes that allowed any more than an inch of clearance around the perimeter of the acrylic would be susceptible to leakage.

Once the formwork was constructed and flown into place by crane, it was reinforced using fiberglass rods. Normally, steel ties are used to reinforce concrete walls, but steel can corrode when it comes in contact with water and leach harmful substances into the tank, so a substitute was needed. Because fiberglass is not as strong as steel, twice the usual number of reinforcing ties had to be installed.

The concrete that was poured into this formwork also required modifications.

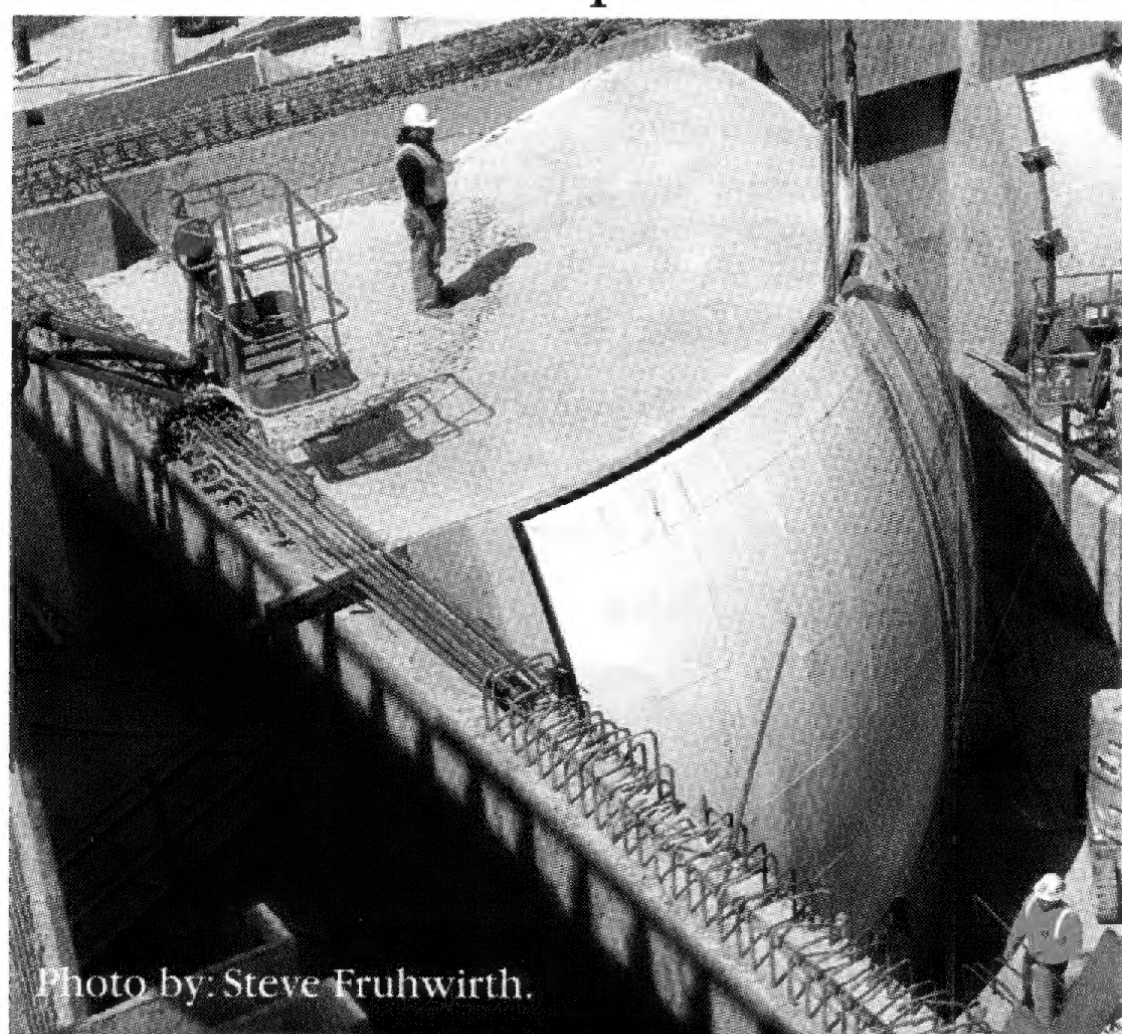


Photo by: Steve Fruhwirth.

The largest viewing panel in the Coral Reef tank weighs over 30,000 pounds.

SUPER-SIZE IT

What does it take to build an aquarium tank that holds over 200,000 gallons of water and doesn't leak? More than three million pounds of concrete laced with two special chemicals, over 40,000 pounds of acrylic, and some serious mathematical equations.



Photo by: Bret DoBel.

The new Coral Reef tank in Golden Gate Park will house the deepest living coral reef display in the world. Five acrylic windows will offer views into the deepest part of the tank (shown in yellow). A shallower section (orange) will house sharks, rays, and sea turtles.

In order to combat concrete's natural tendency to crack, a chemical called Silica Fume was added to the wet concrete before it was poured. This additive increases the density of the concrete and allows less room for cracking during the drying process. As a waterproofing tactic, a second additive called Xypex was mixed into the concrete. Xypex crystallizes and expands when it comes in contact with water, so when the tank is filled with water for the first time, the Xypex will automatically fill any cracks that may exist. Nearly 800 cubic yards of this specially treated concrete were needed to fill the formwork for the Coral Reef tank.

After a month of curing time, the tank was ready to receive its windows. The Academy's acrylic windows were manufactured in Colorado at Reynolds Polymer, where they started their life as a liquid. To transform that liquid into clear, solid windows, Reynolds poured the mixture into flat steel molds and slid the molds into large, pressurized ovens. Acrylic must bake at 175 degrees Fahrenheit in order to properly cure, but it also boils at that temperature, so pressure must be used to prevent the material from bubbling. Because of its large size, the main viewing panel for the Coral Reef tank was baked in four

separate molds during its first stint in the oven, each of which was nine inches thick. In order to properly cure, these panels had to be baked for nine full days. The extra baking time was worthwhile, however—the thickness of the window will allow it to withstand nearly 340,000 pounds of water pressure once the tank is filled. After the panels cooled, they were baked for another nine days in a convection oven so they could be bent into the appropriate curvature. The four sections were then joined together with a special acrylic glue, after which the window needed to bake for a third time to set the adhesive.

Continued on page 17.



Photo by: Reynolds Polymer.

Two of the Academy's smaller windows enter an oven at Reynolds. The acrylic panels must bake for one day per inch of thickness. Panel thickness is determined by the pressure that each window will have to withstand.

PROGRAMS/HIGHLIGHTS

All programs are free with Academy admission unless otherwise noted.

DECEMBER

Story Time
Every Saturday (Except December 23)
10:30 am
Explore nature with a story for children ages 3-5.

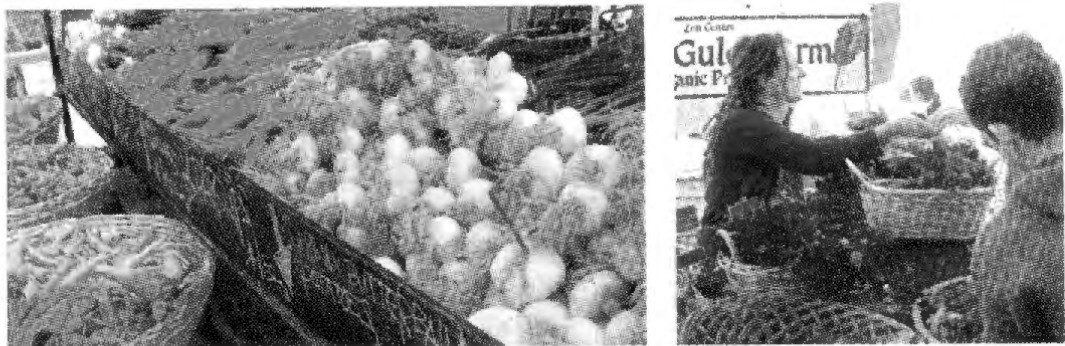
Global Warming Discovery:
A Hands-on Science Demonstration
Sunday, December 3
11:00 am to 4:00 pm
Be a space scientist. Your discoveries on other planets can help save life here on Earth.

JANUARY

Story Time
Every Saturday
10:30 am
Explore nature with a story for children ages 3-5.

Global Warming Discovery:
A Hands-on Science Demonstration
Sunday, January 21
11:00 am to 4:00 pm
Be a space scientist. Your discoveries on other planets can help save life here on Earth.

Teacher Workshop: NEW!!
Education for Sustainability:
Organic and Local (Grades 2-8)
Saturday, January 27
8:00 am-1:00 pm



In this workshop, you actually get to eat the lesson! First, we'll shop at the Farmer's Market for organic and locally grown produce that will ultimately become lunch. Back in the workshop, participants will explore, through appropriate classroom activities, what the organic designation means for the consumer and the environment, and why locally grown is an important consideration as well. Participants will learn the botanically correct term for each fruit, vegetable and nut purchased. Is the potato tuber part of the root or stem system of a plant? Finally, we will prepare and enjoy a healthy, organic and locally grown lunch.

\$40 Academy members and \$45 non-members (includes lunch)
To register call (415) 321-8000 or visit www.calacademy.org

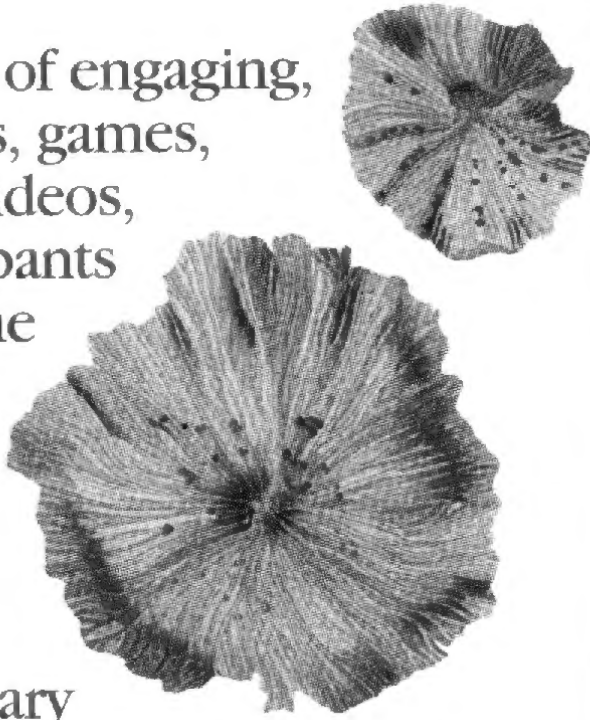
FEBRUARY

Story Time
Every Saturday
10:30 am
Explore nature with a story for children ages 3-5.

Global Warming Discovery:
A Hands-on Science Demonstration
Sunday, February 4
11:00 am to 4:00 pm
Be a space scientist. Your discoveries on other planets can help save life here on Earth.

Teacher Workshop: NEW!!
Corals and the Coral Reef:
Science and Conservation (Grades 3-6)
Wednesday, February 7
4:00-6:00 pm

Through a variety of engaging, hands-on activities, games, and educational videos, workshop participants will learn about the physical structure of a coral polyp, how corals reproduce, and the critical conditions necessary for coral survival that determine where they live. Learn in detail about Steinhart Aquarium's coral reef exhibits and plans for the expanded exhibit in the new Academy. This workshop introduces the new Educator Resource Materials kit on corals and the coral reef ecosystem, which can be borrowed from the Academy for classroom use.

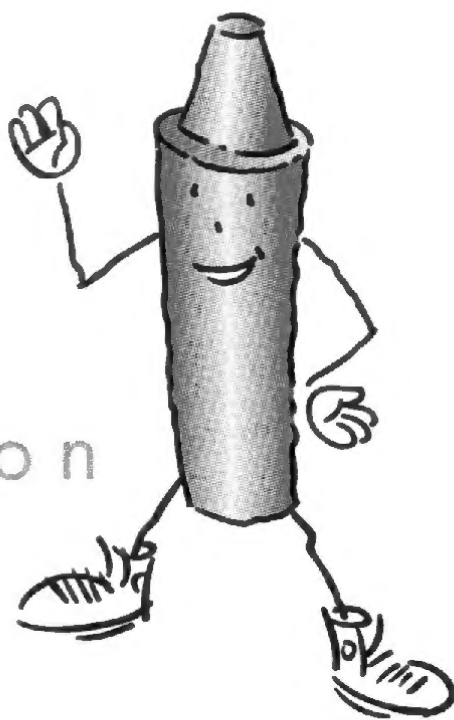


\$20 Academy members and \$25 non-members
To register call (415) 321-8000 or visit www.calacademy.org

Fantastic Fish Arts & Crafts
Fridays, February 9, 16 & 23
1:00 pm

What kind of fish will you create? Purple Crayon will provide the materials and know-how for you to express your creativity. Take home a sea creature of your very own!

purple crayon



Meet the Biologist
Every Saturday and Sunday, starting on Saturday February 10
2:00 pm
Meet an Academy biologist and discover how to care for aquarium creatures. Depending on the animal you visit, you may learn how to take and test water samples, check filters, clean tanks, or administer appropriate amounts of food.

BioForum: Symposium for Educators and the General Public
The Implications of Evolution: Evidence and Applications
Saturday, February 10

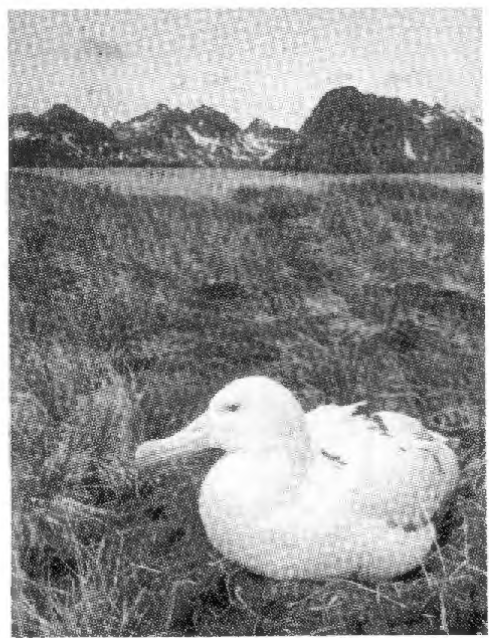
8:30 am-4:00 pm
At the University of California Museum of Paleontology, Berkeley
Join experts in diverse fields of science as they examine the different lines of evidence for evolution and how evolution informs us about our natural world. Presentations will be followed by a panel discussion on the importance of teaching evolution in our science classrooms. This BioForum is jointly sponsored and produced by the California Academy of Sciences, University of California Museum of Paleontology, and California Science Teachers Association.

Moderator: Eugenie Scott, Ph.D., National Center for Science Education

\$25 Academy member, \$30 non-member, \$15 student teacher
To register call (415) 321-8000 or visit www.calacademy.org

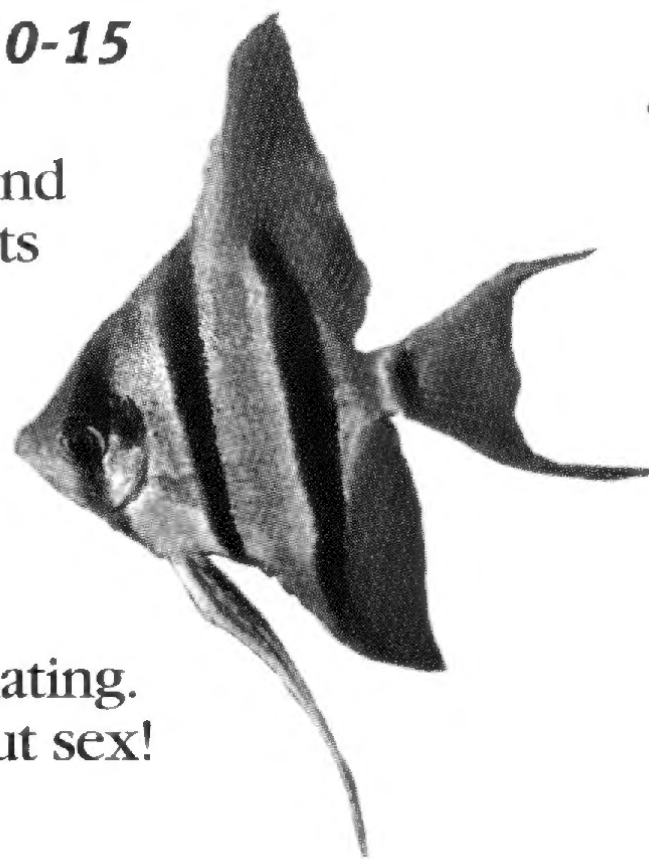
Seabirds and Marine Mammals of the Southern Ocean
Saturday, February 10
1:00 pm

See a brief slide show, touch preserved specimens, and explore the life history of the seabirds and marine mammals of the Southern Ocean.



Academy Sex Tours
Every Day, February 10-15
11:30 am

Love is in the air, on land and in the sea! Docents will be giving tours about the fascinating reproductive practices of fish, reptiles, amphibians and other creatures. Reproduction is fascinating. Yes, the tours are about sex!



Family Nature Crafts**Sundays, February 11, 18 & 25****10:30 am**

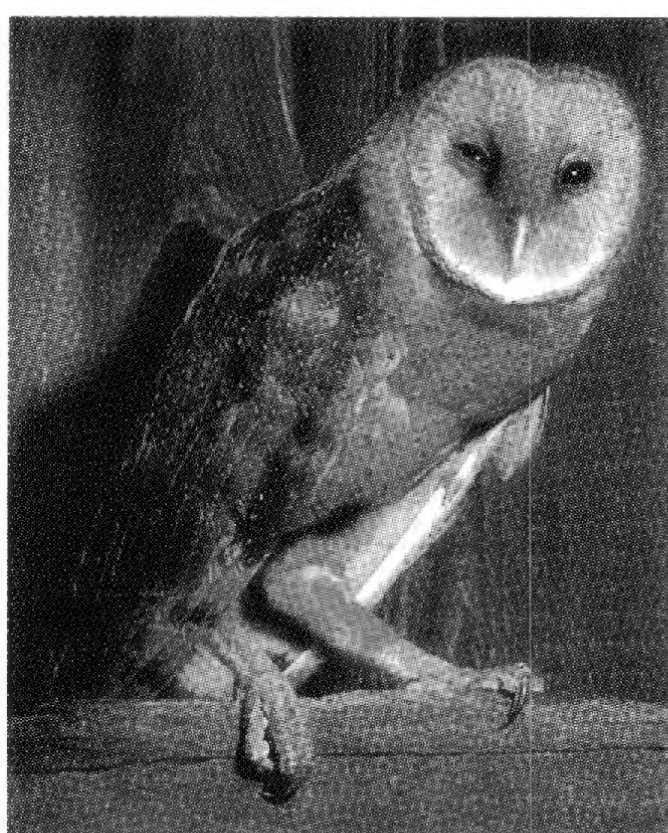
Enjoy simple nature-inspired projects designed for children (ages 4-8) and their caregivers.

Vanishing Vernal Pools**Sunday, February 11****1:00 pm**

Meet a tiger salamander, and discover its extraordinary story of survival in California's vernal pool habitat. Handle live earthworms, learn to read the secret code of "wildflower rings," and find out why your help is needed to keep California's vernal pools from vanishing forever.

Creature Feature: Owls & Their Prey**Saturday,****February 17****& Monday,****February 19****1:00 pm**

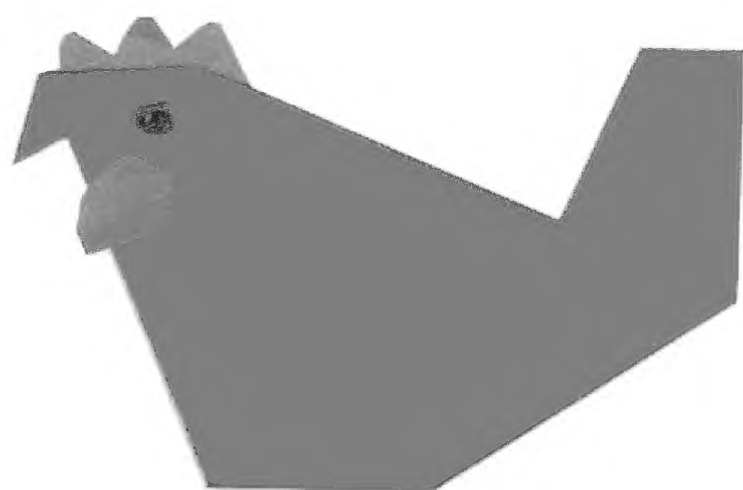
Learn about the natural history of barn owls and dissect owl pellets with Careers in Science interns. Practice using a simple dichotomous key to identify the skulls found in owl pellets.

**California Endangered Wildlife****Sunday, February 18****1:00 pm**

Meet a live California desert tortoise, and learn what this animal and other endangered species need to help them survive in our changing world.

Folding Fun—Origami is for Everyone!**Monday,****February 19****10:30 am**

Make your own origami craft to take home (ages 4 and up).

**Chinese Lunar New Year Celebration****Sunday, February 18–****Sunday, March 4**

How is the Chinese New Year determined and what does it have to do with the moon?

What customs are observed on

and around the

New Year? What

is the Year of the

Boar? Join the

Academy in welcoming

the Year of the

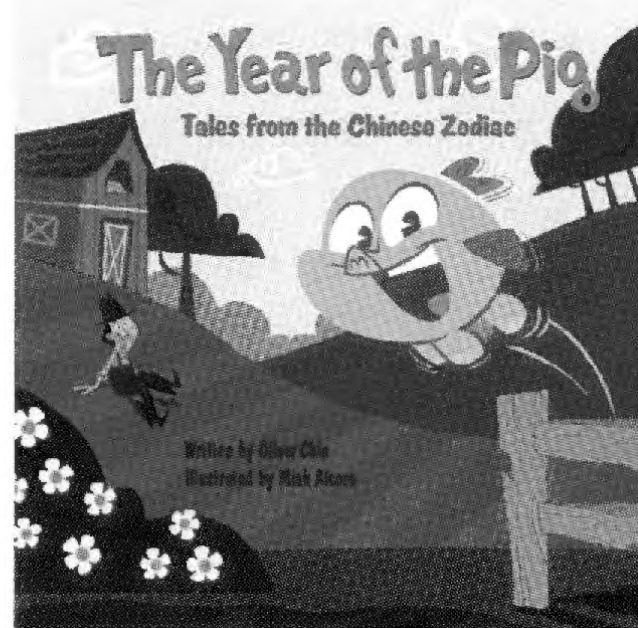
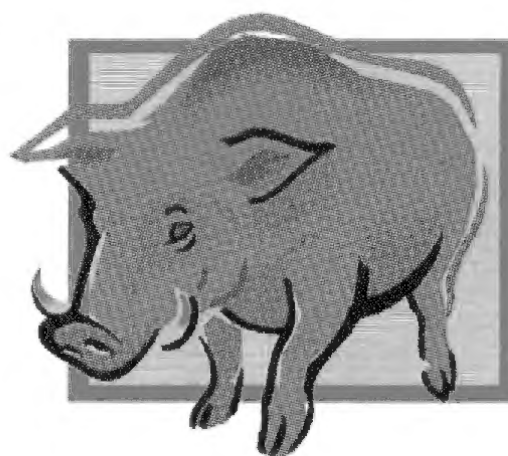
Boar with a series of

special activities and

demonstrations,

including storyteller Oliver Chin on February 18.

Check calacademy.org for a complete schedule of festivities in honor of the 4,705th Lunar New Year!

**The "Mini-Morrison" Planetarium****Monday, February 19****Hourly, from 10:30 am - 4:30 pm**

It's not quite the same as the Academy's spectacular new Morrison Planetarium that is currently under construction in Golden Gate Park, but you can take a 15-minute tour of the night sky inside our portable, 16-foot planetarium dome and learn about the visible constellations, the planets, and the moon! Capacity limited to 20 people per show.

The Dungeness Crab**Saturday, February 24****1:00 pm**

See real crab larvae and crab specimens, and explore the life cycle of the Dungeness Crab, subject of the largest and most profitable crab fishery in the state of California.

Wild Animal Mimics**Sunday, February 25****1:00 pm**

Meet a live snake that pretends to be venomous, and see other examples of insects, birds and reptiles that try to fool other animals in order to survive.

**More lectures
on page 19**

Special Lecture

at the Jewish Community Center of San Francisco, in collaboration with the Leakey Foundation



The Leakey Foundation

Location:

Jewish Community Center of San Francisco,
3200 California St. (at Presidio)

Tickets: \$8 members/

\$10 non-members/ \$6 students

Tickets can be purchased by calling (415)
321-8000 or at the door, when available.

For more information:

www.leakeyfoundation.org

Who Were the Neandertals?**Howard Dibble, Ph.D.**

**Professor of Anthropology,
University of Pennsylvania**

Thursday, February 1, 8:00 pm

The biological and cultural relationship between the Neandertals and modern *Homo sapiens* is regarded as one of the most controversial subjects in studies of human evolution. Though archaeology provides the primary data for understanding Neandertal behavior, interpreting such ancient material remains is always challenging. Drawing on recent excavations in France and Egypt, Dibble highlights some of the major problems that scientists face, and presents new finds that shed important light on the past life of Neandertals.

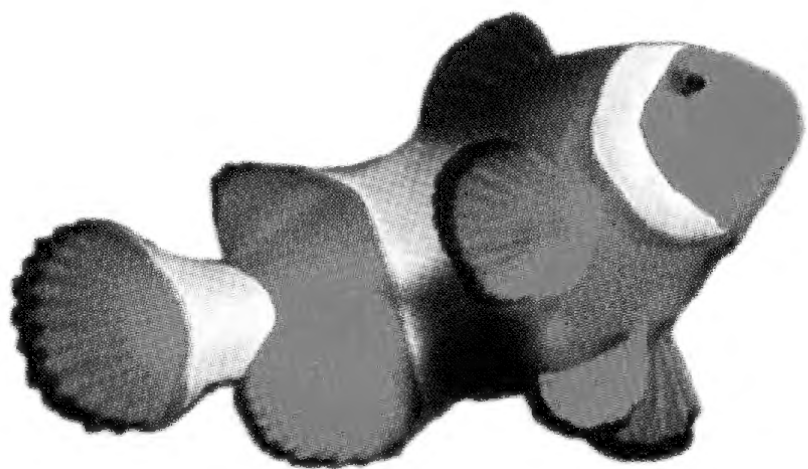
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Monday




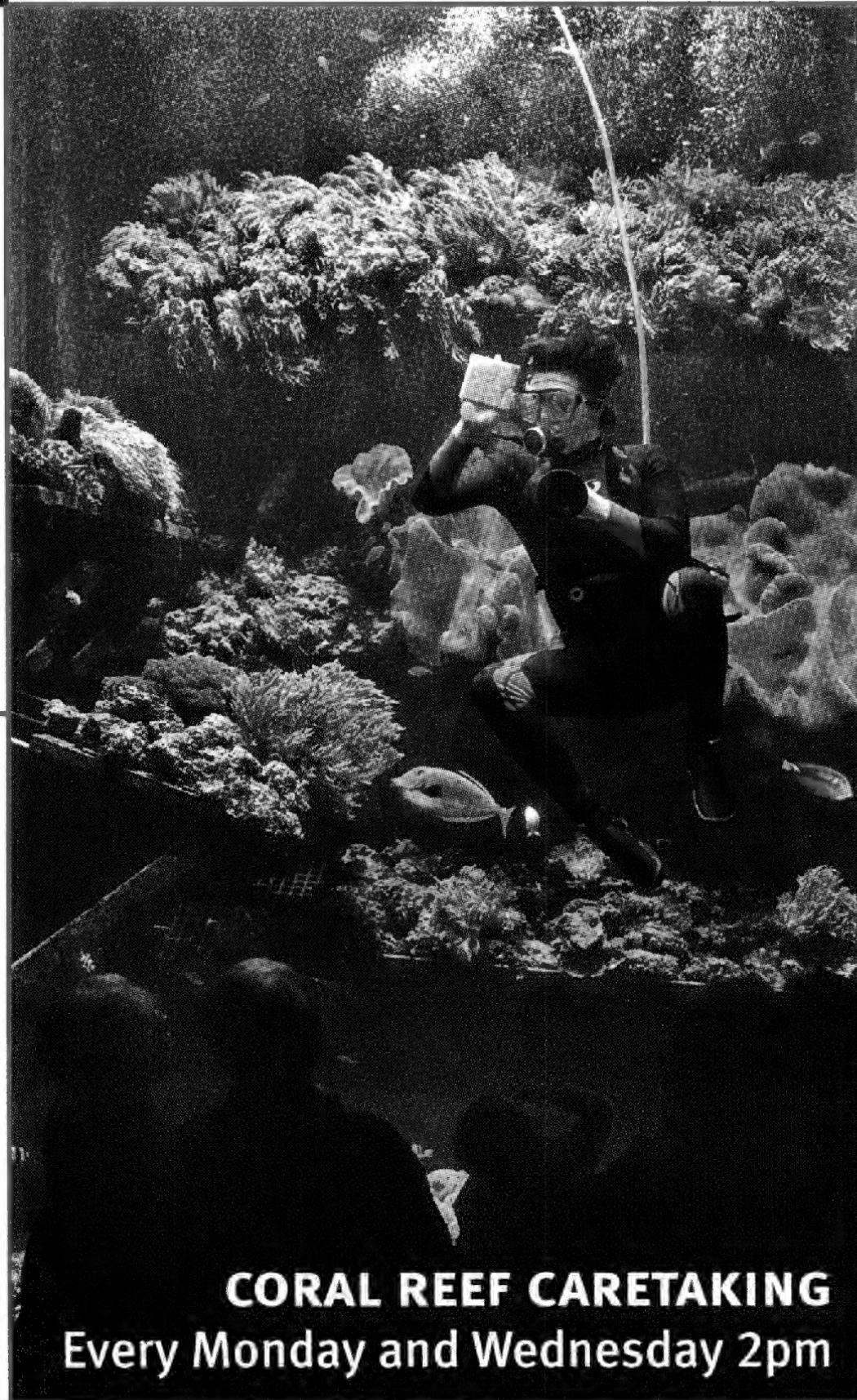

Tuesday

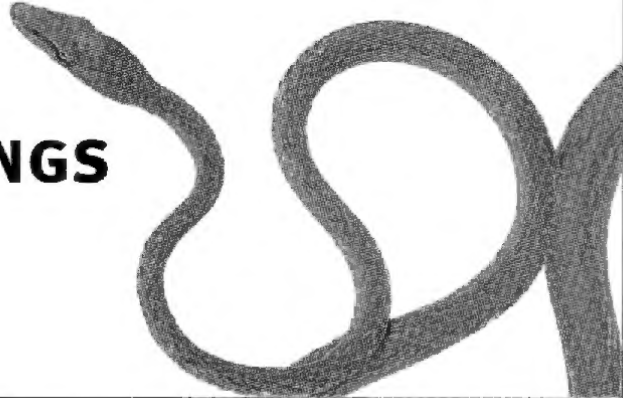
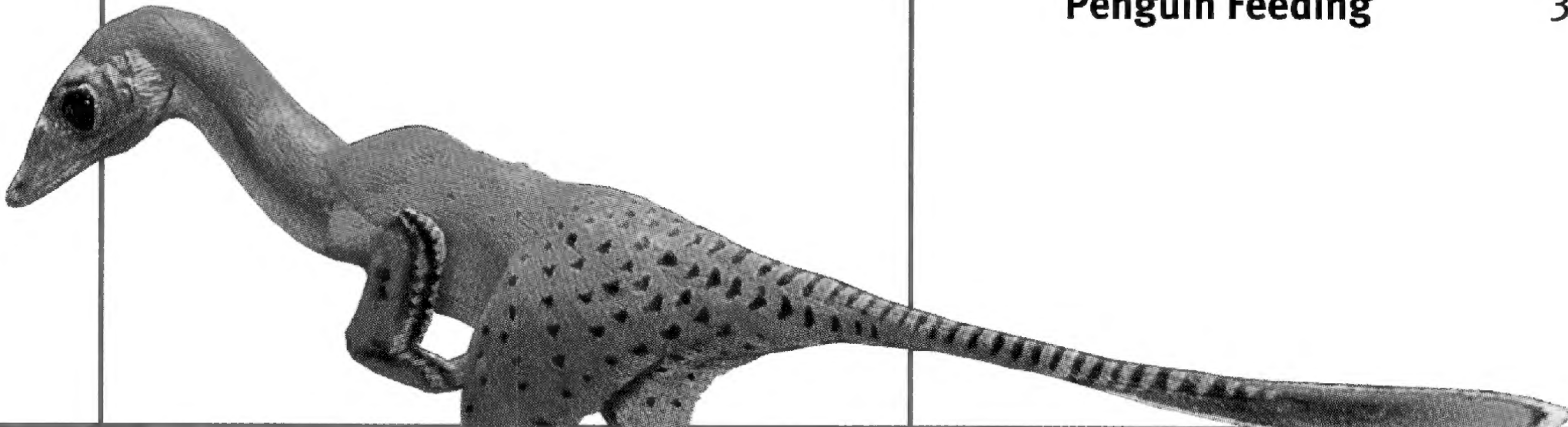



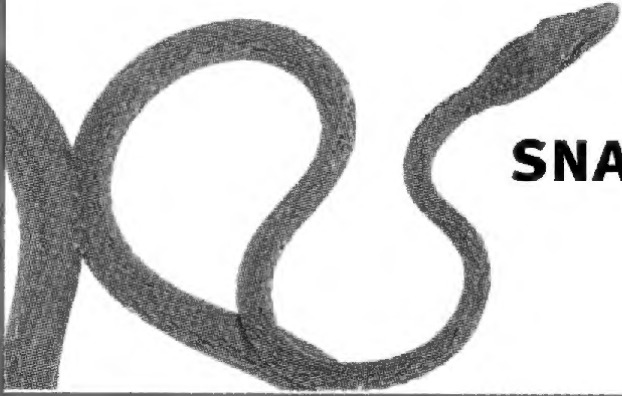


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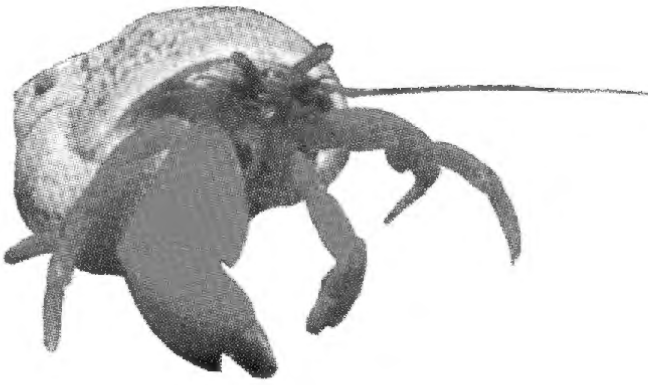
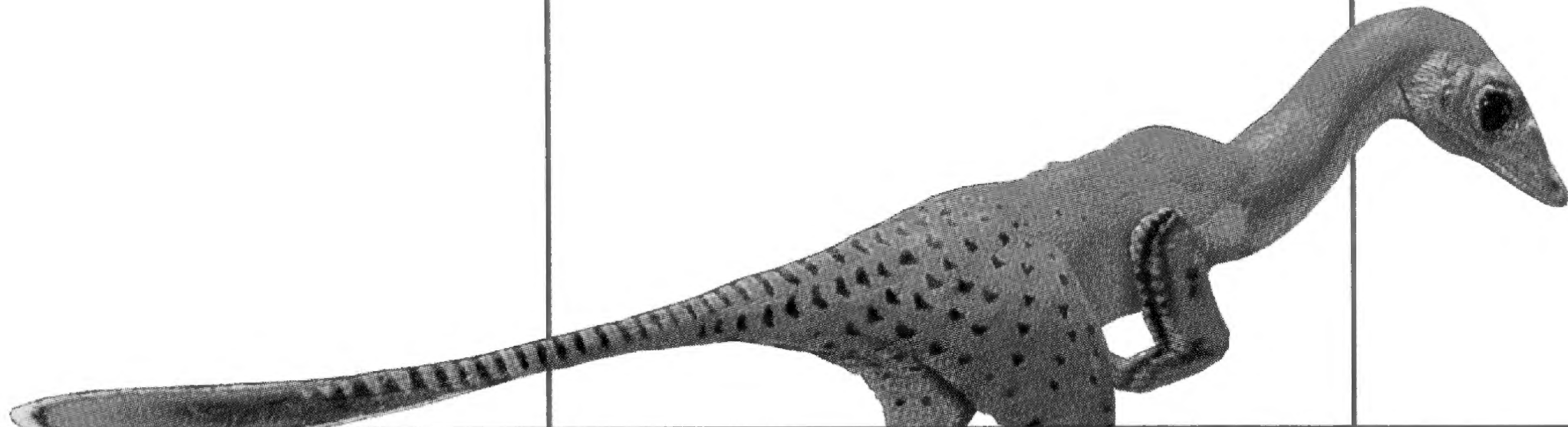
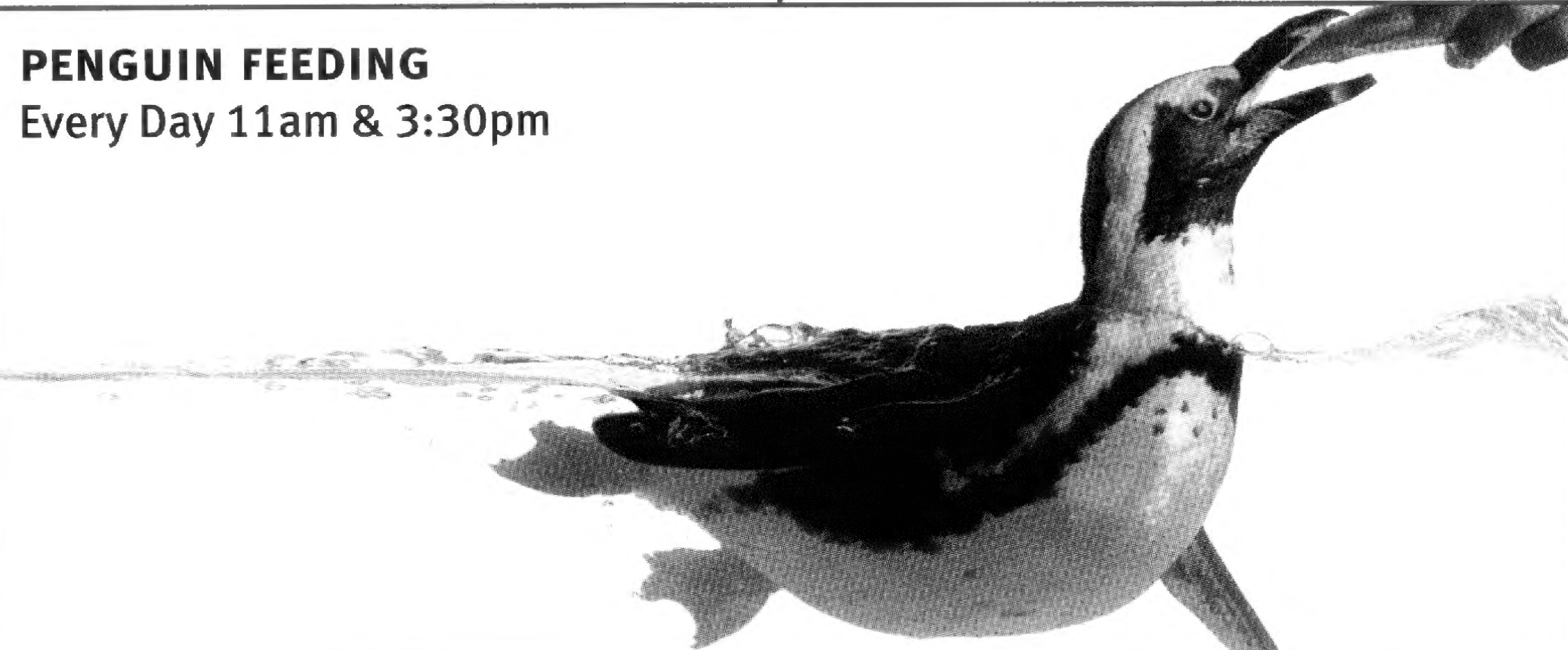


DECEMBER



All programs are free with Academy admission unless otherwise noted.
Please see Programs and Highlights on pages 6 and 7 or Lectures on pages 7 and 19 for a full description.
For more information, visit: www.calacademy.org.

<div>3</div> <div>Global Warming Discovery</div> <div>Penguin Feeding</div> <div>Penguin Feeding</div> <div>11:00am</div> <div>11:00am</div> <div>3:30pm</div>	<div>4</div> <div>Penguin Feeding</div> <div>Coral Reef Caretaking</div> <div>Penguin Feeding</div> <div>11:00am</div> <div>2:00pm</div> <div>3:30pm</div>	<div>5</div> <div>Penguin Feeding</div> <div>Academy Lecture</div> <div>Penguin Feeding</div> <div>Academy Lecture</div> <div>11:00am</div> <div>2:00pm</div> <div>3:30pm</div> <div>7:30pm</div>	<div>6</div> <div>Penguin Feed</div> <div>Coral Reef Ca</div> <div>Penguin Feed</div>	
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<div>17</div> <div>Penguin Feeding</div> <div>Penguin Feeding</div> <div>11:00am</div> <div>3:30pm</div> <div><div><div>Discount Shopping Day for Members</div></div></div>	<div></div> <div>CORAL REEF CARETAKING Every Monday and Wednesday 2pm</div>		<div>19</div> <div>Penguin Feeding</div> <div>Penguin Feeding</div> <div>11:00am</div> <div>3:30pm</div>	<div>20</div> <div>Penguin Feed</div> <div>Coral Reef Ca</div> <div>Penguin Feed</div>
<div>24</div> <div>Penguin Feeding</div> <div>Penguin Feeding</div> <div>11:00am</div> <div>3:30pm</div>	<div>PENGUIN FEEDING Every Day 11am & 3:30pm</div> <div></div>			
<div>31</div> <div>Penguin Feeding</div> <div>Penguin Feeding</div> <div>11:00am</div> <div>3:30pm</div>				

Wednesday	Thursday	Friday	Saturday
<div>SUPPORT THE ACADEMY BY SHOPPING ONLINE</div> <div>http://calacademy.freepledge.com</div>		<div><div>1</div><div>Members Hours9:30am</div><div>Penguin Feeding11:00am</div><div>Snake Feeding2:00pm</div><div>Penguin Feeding3:30pm</div></div> <div><div>SNAKE FEEDINGS</div><div>Every Friday</div><div>2pm</div></div> <div></div>	<div><div>2</div><div>Story Time10:30am</div><div>Penguin Feeding11:00am</div><div>Penguin Feeding3:30pm</div></div>
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<div></div>	<div><div>28</div><div>Penguin Feeding11:00am</div><div>Penguin Feeding3:30pm</div></div>	<div><div>29</div><div>Members Hours9:30am</div><div>Penguin Feeding11:00am</div><div>Snake Feeding2:00pm</div><div>Penguin Feeding3:30pm</div></div>	

Sunday			Monday			Tuesday			Wedn		
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<div>PENGUIN FEEDING</div> <div>Every Day 11am & 3:30pm</div> <div></div>			<div>16</div> <div>Academy Lecture</div> <div>2:00pm</div> <div>Penguin Feeding</div> <div>11:00am</div> <div>Penguin Feeding</div> <div>3:30pm</div> <div>Academy Lecture</div> <div>7:30pm</div>			<div>17</div> <div>Penguin Feed</div> <div>Coral Reef Ca</div> <div>Penguin Feed</div>					
<div>21</div> <div>Global Warming</div> <div>Discovery</div> <div>11:00am</div> <div>Penguin Feeding</div> <div>11:00am</div> <div>Penguin Feeding</div> <div>3:30pm</div>			<div>22</div> <div>Penguin Feeding</div> <div>11:00am</div> <div>Coral Reef Caretaking</div> <div>2:00pm</div> <div>Penguin Feeding</div> <div>3:30pm</div>			<div>23</div> <div>Penguin Feeding</div> <div>11:00am</div> <div>Penguin Feeding</div> <div>3:30pm</div> <div>Conversations at</div> <div>the Herbst Theatre</div> <div>8:00pm</div> <div>*Herbst</div>			<div>24</div> <div>Penguin Feed</div> <div>Coral Reef Ca</div> <div>Penguin Feed</div> <div>Home School</div>		
<div>28</div> <div>Penguin Feeding</div> <div>11:00am</div> <div>Penguin Feeding</div> <div>3:30pm</div>			<div><div>CORAL REEF CARETAKING</div><div>Every Monday and Wednesday 2pm</div></div>			<div>30</div> <div>Penguin Feeding</div> <div>11:00am</div> <div>Penguin Feeding</div> <div>3:30pm</div> <div></div>			<div>31</div> <div>Penguin Feed</div> <div>Coral Reef Ca</div> <div>Penguin Feed</div>		

Sunday

Monday

Tuesday

Wednesday

FEBRUARY

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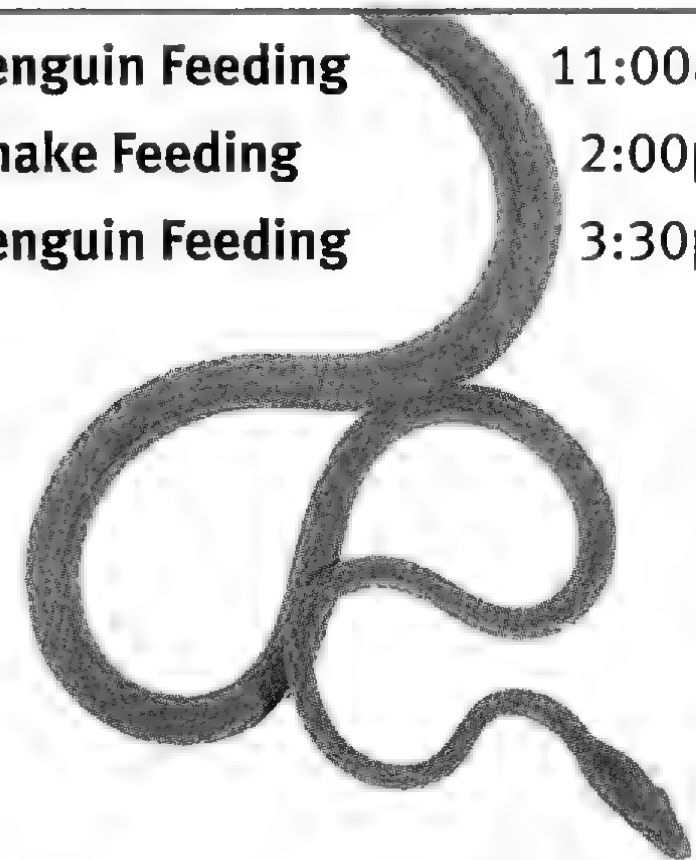




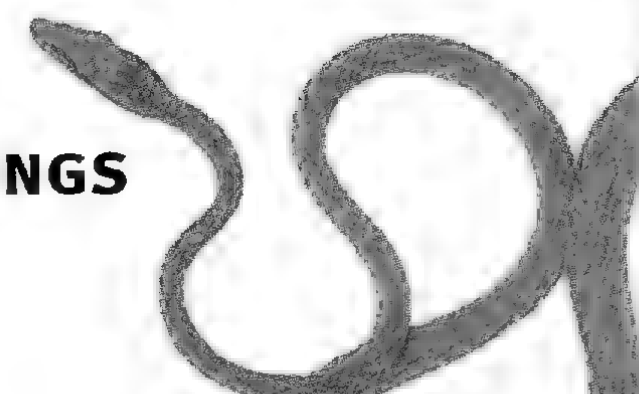

<div>4</div> <div>Global Warming Discovery Penguin Feeding Penguin Feeding <i>Last day for DINOSAURS exhibit!</i></div> <div></div>	<div></div> <div><div>CORAL REEF CARETAKING Every Monday and Wednesday 2pm</div></div>	<div>6</div> <div>Penguin Feeding Penguin Feeding</div> <div></div>	<div>7</div> <div>Penguin Feeding Coral Reef Caretaking Penguin Feeding Teacher Workshop Corals and the Ocean</div> <div></div>
<div>11</div> <div>Family Nature Crafts Penguin Feeding Academy Sex Tours Vanishing Vernal Pools Meet the Biologist Penguin Feeding</div> <div></div>	<div>12</div> <div>Penguin Feeding Academy Sex Tours Coral Reef Caretaking Penguin Feeding Happy Birthday Charles Darwin!</div> <div></div>	<div>13</div> <div>Penguin Feeding Academy Sex Tours Penguin Feeding</div> <div></div>	<div>14</div> <div>Penguin Feeding Academy Sex Tours Coral Reef Caretaking Penguin Feeding</div> <div></div>
<div>18</div> <div>Penguin Feeding Chinese Lunar New Year Celebration  Family Nature Crafts California Endangered Wildlife Meet the Biologist Penguin Feeding</div>	<div>19</div> <div>The "Mini-Morrison" Planetarium Folding Fun— Origami is for Everyone! Penguin Feeding Creature Feature: Owls & Their Prey Coral Reef Caretaking Penguin Feeding PRESIDENTS' HOLIDAY</div> <div></div>	<div>20</div> <div>Penguin Feeding Academy Lecture Penguin Feeding Academy Lecture</div> <div></div>	<div>21</div> <div>Penguin Feeding Raptor Dinosaurs Raptor Dinosaurs Coral Reef Caretaking Penguin Feeding</div> <div></div>
<div>25</div> <div>Penguin Feeding Family Nature Crafts Wild Animal Mimics Meet the Biologist Penguin Feeding</div> <div></div>	<div></div> <div>CORAL REEF CARETAKING Every Monday and Wednesday 2pm </div>	<div>27</div> <div>Penguin Feeding Penguin Feeding</div> <div></div>	<div>28</div> <div>Penguin Feeding Coral Reef Caretaking Penguin Feeding </div>

Wednesday

Thursday

Friday

Saturday

	<div>1</div> <div>Penguin Feeding 11:00am Penguin Feeding 3:30pm Special Lecture 8:00pm *JCC</div>	<div>2</div> <div>Penguin Feeding 11:00am Snake Feeding 2:00pm Penguin Feeding 3:30pm</div> 	<div>3</div> <div>Story Time 10:30am Penguin Feeding 11:00am Penguin Feeding 3:30pm</div>
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Birds of a Feather?



Variable Pitohui (*Pitohui kirhocephalus*)

Photo by: Jack Dumbacher.

Through DNA testing, Academy ornithologist Jack Dumbacher has found that some birds previously assigned the same name are actually separate species.

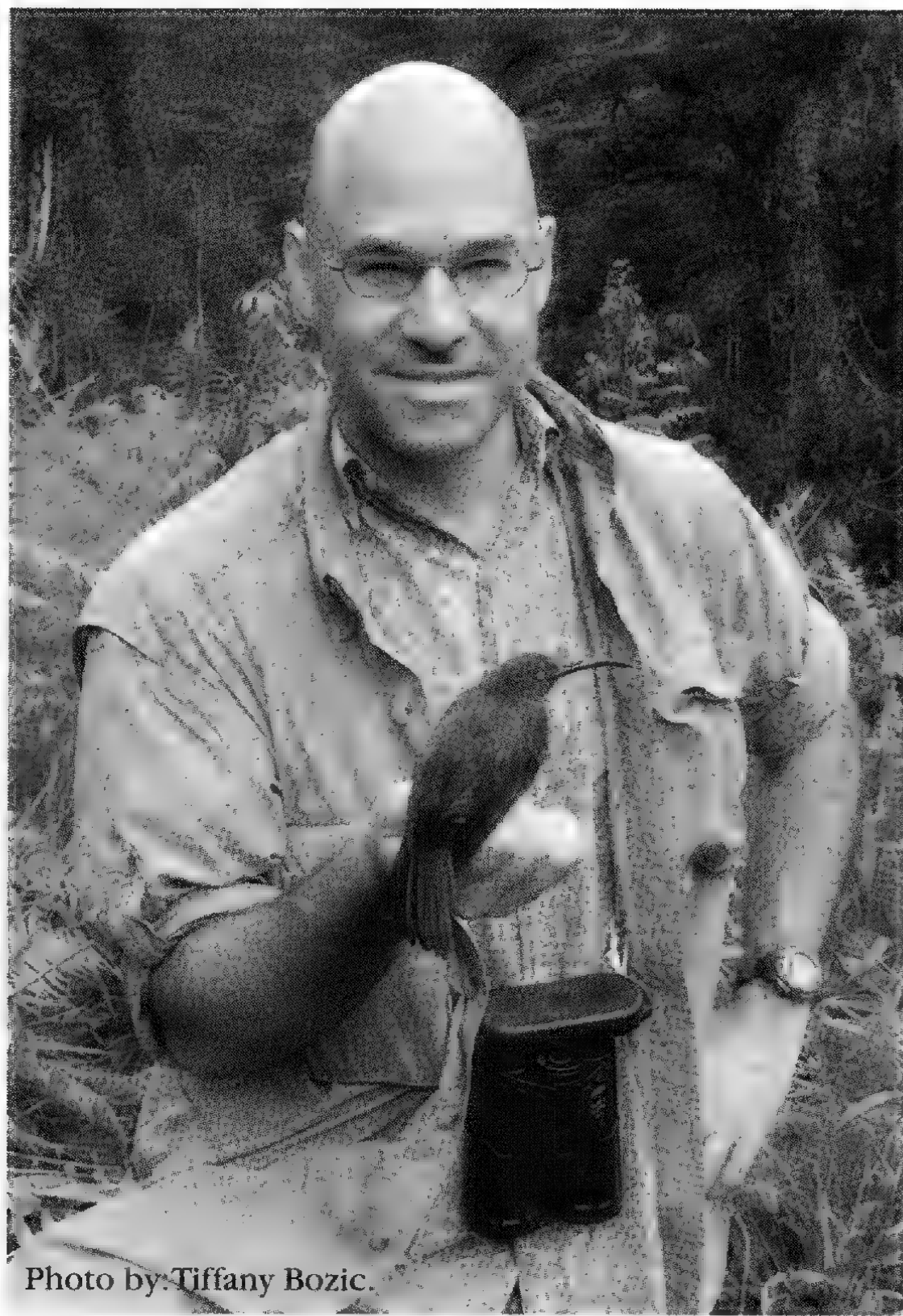


Photo by: Tiffany Bozic.

*Above: Academy curator Dr. Jack Dumbacher with a Long-billed Honeyeater (*Melilestes megarrhynchus*) in Papua New Guinea. Dumbacher is currently working to create an accurate distribution map of the island's birds.*

Top: After testing their DNA, Dumbacher found that birds currently classified as Variable Pitohuis have more genetic variation than entire genera of North American birds.

Two birds fly through the jungles of Papua New Guinea, sporting very similar plumage. Although they have historically been classified as two members of the same species, they inhabit separate parts of the island, and recent DNA testing has shown that they share only 92 percent of their genetic code. These two animals are therefore twice as different from one another as humans and chimps, which are a 96 percent genetic match. Clearly, this new data indicates that the birds should be reclassified as two distinct species. What may not be as readily apparent, at least to non-scientists, is why a known bird receiving a new name should be a noteworthy occasion.

"Biodiversity is disappearing from our planet at an astonishing rate," says Academy curator Dr. Jack Dumbacher. "If we're going to make informed decisions about how to halt that trend, we need to understand how biodiversity is distributed across the planet. Accurately naming new species and subspecies helps us to create a more meaningful map of biodiversity distribution." It is also a necessary prerequisite for achieving legal protection for threatened habitats in the United States. No legislation has ever been passed that directly protects endangered habitats or ecosystems.

However, because of the Endangered Species Act of 1973, it is possible to protect individual species, subspecies, and distinct population segments. Under this legislation, habitats can also be protected if they are deemed essential for the recovery of an endangered species. Thus, the process of finding, naming, and mapping new species has taken on additional importance over the past few decades.

This is precisely the type of work that Academy scientists do every day, both by conducting fieldwork around the world and by analyzing the roughly 20 million specimens in the museum's research collections. In recent months, Dumbacher has discovered new species of birds through both his fieldwork in Papua New Guinea and his work with the Academy's collection of avian specimens, which includes over 92,000 skins, skeletons, nests, eggs, and tissue samples.

Located almost directly on the equator, Papua New Guinea is the largest tropical island in the world. Although it contains less than 1 percent of the planet's land, it houses 8 percent of the known species of birds. For the past several years, Dumbacher has been working to create an accurate distribution map of these birds across the

island, focusing his efforts on six species whose members seemed to display a high degree of variation. By conducting DNA analysis on samples from hundreds of birds around the island, he found that three of these species should probably be broken up into a total of 11 or 12 separate genetic species. "It turns out that some of the birds that were previously grouped together in the same species had more genetic variation than entire genera of birds in North America," Dumbacher explains. "Within a species, you generally see less than 2 percent variation between individuals. But the birds categorized as Variable Pitohuis in New Guinea had up to 8 percent sequence divergence." Barred owl-nightjars and little shrike-thrushes also contained enough genetic variation to warrant separation into multiple species.

The new species distribution maps that Dumbacher has created for New Guinea's birds will help inform future conservation decisions in the country. Meanwhile, his work with the Academy's specimen collection is helping to inform the recovery efforts for a species closer to home.

An American legend, the Ivory-Billed Woodpecker is a large, showy bird that reportedly went extinct when the bottomland forests of North America were logged. For over 60 years, scientists searched unsuccessfully for a surviving member of the species. Then, in 2004, an Ivory-Billed male was photographed in eastern Arkansas. This sighting, along with recent reported sightings in Florida, has sparked hope for the recovery of the species, which was once found throughout much of the southeastern United States and in the forests of Cuba. Because the birds are elusive and extremely rare, finding fallen feathers may be one of the easiest ways to track them. In order to definitively identify any feathers they may find, however,

scientists must be able to match the DNA from those feathers to DNA from Ivory-Billed Woodpecker specimens. Therefore, Dumbacher teamed up with colleagues from five other museums and universities to establish a DNA databank for Ivory-Billed specimens that were collected in the late 19th and early 20th century.

Dumbacher and his colleagues were able to extract DNA samples from ten Ivory-Billed Woodpecker specimens, two of which are housed in the Academy's ornithology collection, by taking small snippets of toe pad tissue from each of the valuable specimens. They also tested the DNA from three Imperial Woodpeckers, the closest living relatives of the Ivory-Billed birds. The resulting data showed that the Ivory-Billed Woodpeckers in North America and Cuba were actually just as different from one another as each of them was from the Imperial Woodpecker. "We realized that we were actually looking at two separate species of critically endangered birds, at least one of which may very well be extinct, since Ivory-Billed Woodpeckers haven't been documented in Cuba in decades," says Dumbacher.

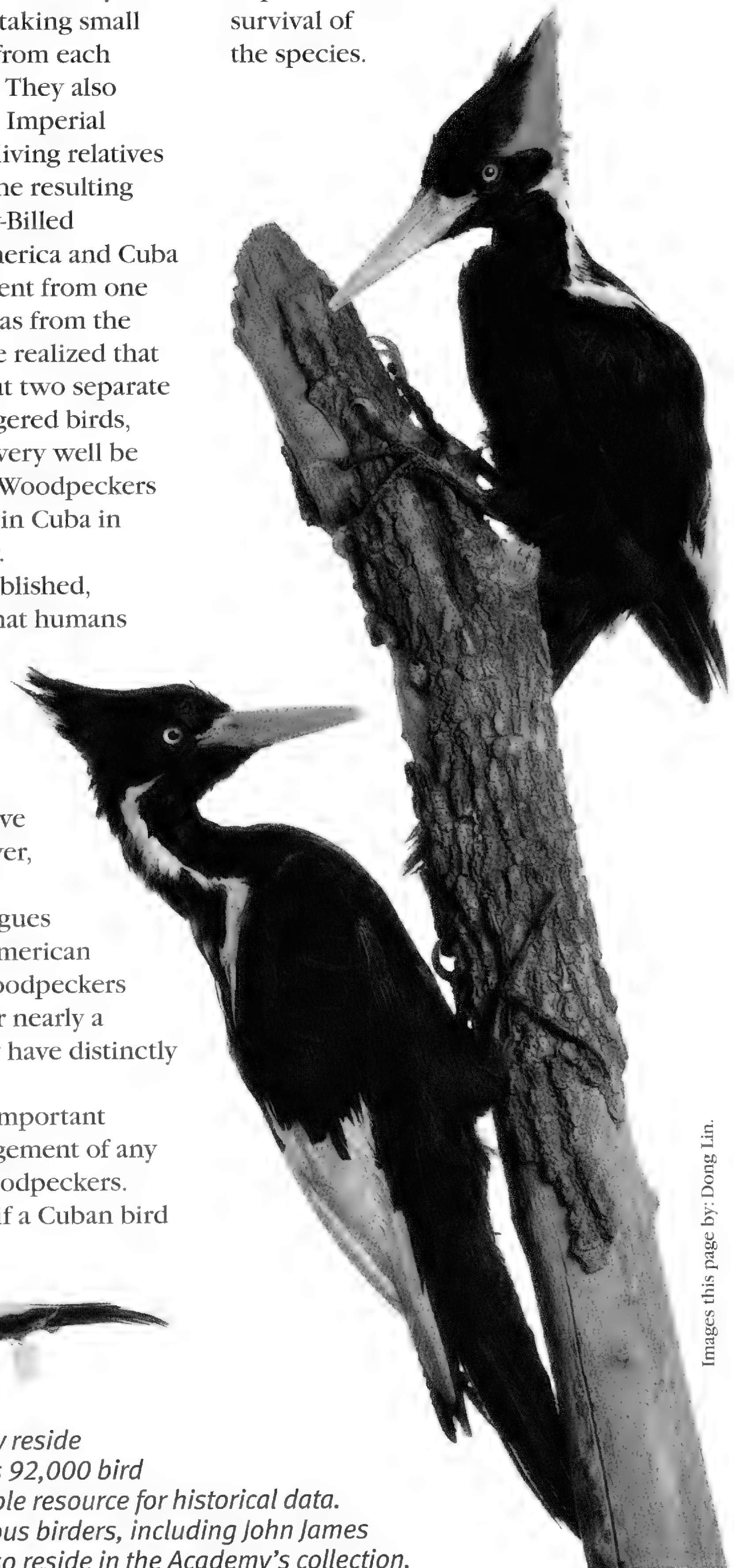
Until this data was published, many scientists believed that humans introduced Ivory-Billed Woodpeckers to Cuba relatively recently and that the birds had not been isolated on the island long enough to evolve into a new species. However, the DNA data collected by Dumbacher and his colleagues indicates that the North American and Cuban Ivory-Billed Woodpeckers diverged from one another nearly a million years ago and now have distinctly different DNA.

These findings have important implications for the management of any remaining Ivory-Billed Woodpeckers. Scientists now know that if a Cuban bird

is found in the future, interbreeding efforts between the North American and Cuban cousins would probably not be fruitful. They also have a definitive way to assess whether any potentially significant feathers that may be found belong to the rare Ivory-Billed Woodpecker or the more common Pileated Woodpecker. This new ability to track the birds through their feathers will help conservation managers decide which habitats are most important to protect for the survival of the species.



Above: These two Ivory-Billed Woodpeckers were collected in 1894 and now reside in the Academy's ornithology collection. Nearly 70 percent of the museum's 92,000 bird specimens were collected prior to 1925, making the collection a very valuable resource for historical data. Right: the Ivory-Billed Woodpecker has been admired by a long line of famous birders, including John James Audubon and President Theodore Roosevelt. These mounted specimens also reside in the Academy's collection.



Images this page by: Dong Lin.

December 4 ○

Full Moon at 4:24 pm PST against the stars of Taurus. Watch how high this and the next Full Moon arc across the sky – just the opposite of the low-crossing Winter Sun. The Tlingit called this the “Groundhog Mother’s Moon,” the Osage the “Baby Bear Moon,” and to the Zuni it was the “Turning Moon.”

December 13-14 ★

Peak of the annual **Geminid meteor shower**, usually the year’s best display with 50 meteors per hour, but not as well known as Summer’s Perseids, because few people stay out late to look at the sky on cold, December nights. Coinciding with a waxing gibbous Moon, this year’s shower will be somewhat obscured by moonlight, but since the shower’s radiant point is visible for most of the night, this is one of the few displays that can put on a decent show before midnight.

December 20 ●

New Moon at 6:00 am PST – too late in the morning to produce a visible crescent by sunset. Tomorrow night’s appearance of the crescent at sunset marks the start of the month Zul-Hijjah in the lunar based Islamic calendar.

December 21

Winter Solstice at 4:25 pm PST. Earth’s North Pole is at its maximum tilt away from the Sun, which – as seen from the ground – makes its lowest, shortest arc across the sky. From this day forward the days grow longer and warmer. This day was once considered Midwinter’s Day in the Northern Hemisphere, though modern usage now defines it as the beginning of Winter. In the Southern Hemisphere, where the South Pole is tilted toward the Sun and the seasons are reversed, this is the Summer Solstice.

Podcasts

TOUR OF WINTER’S NIGHT SKY
and LUNAR CALENDAR

can be downloaded at calacademy.org

January 3 ○

Full Moon at 5:58 am PST, setting at about dawn. This was called the “Moon of the Terrible” by the Dakotah Sioux, the “Younger Moon” by the Haida, and the “Frost-Fish Moon” by the Micmac. Earth at **perihelion**, or closest to the Sun, at 91,419,000 miles, compared to its average distance of 93,000,000 miles. Occurring in the wintertime for the Northern Hemisphere, this shows that the seasons are not the result of Earth’s distance from the Sun, but rather are caused by the tilt of Earth’s axis.

January 3-4 ★

Peak of the usually-impressive **Quadrantid meteor shower**, with 40 meteors per hour, but the light of the Full Moon spoils the show and washes most of the meteors from view.

January 18 ●

New Moon at 8:01 pm PST (calendars based on Greenwich Time list this as occurring early on the 19th, but converting to Pacific Time backs it up one day). Sighting of the thin crescent low in the west tomorrow night (the 19th) after sunset will mark the start of the new year and the month Muharram in the Islamic calendar. Because a purely lunar-based calendar is 354 days long, the Islamic new year begins 11 days earlier from one year to the next.

February 1 ○

Full Moon at 9:46 pm PST (some calendars list this on the 2nd – see above). The Choctaw name for this Moon is the “Little Famine Moon,” while the Osage called it the “Light of Day Returns Moon,” and the Natchez called it the “Chestnut Moon.”

February 17 ●

New Moon at 8:15 am PST. The first crescent isn’t visible until tomorrow at sunset, when its sighting will mark the start of the month Safar in the lunar-based Islamic calendar. According to the traditional Chinese calendar, which is based on both solar and lunar movements, the second New Moon after the Winter Solstice marks the start of the new year – Happy 4705, the Year of the Boar!



The New Year begins on January 1st, but not for everyone. The traditional western calendar is based on the apparent movement of the Sun, resulting in a 365¼-day long year. Other cultures, however, base their calendars on the apparent motions of the Moon, marking the beginning of each month at either the Moon’s New or Full phase. In the Islamic calendar, each month begins with the sighting at sunset of the first crescent following a new Moon, which occurs every 29½ days. In this calendar, twelve months pass in 354 days, and 1 Muharram, or New Year’s Day, falls 11 days earlier from year to year (in 2007, on January 19th).

Other calendars combine lunar and solar systems so that certain holidays always occur during certain seasons, with “intercalary dates” inserted when necessary (a calendric “fudge factor”) to maintain the seasonal lock. Rosh Hashanah, one of four New Years in the Hebrew calendar, begins at sundown on the first day of Tishri, which is usually in either September or October (September 13th in 2007). The Chinese New Year, on the other hand, usually falls on the second new Moon after the Winter Solstice, or, in 2007, on February 18th – this quarter’s third New Year’s Day.

	SUNRISE	LOCAL NOON	SUNSET
DECEMBER 1	7:06 AM PST	11:59 AM PST	4:51 PM PST
JANUARY 1	7:25 AM PST	12:13 PM PST	5:02 PM PST
FEBRUARY 1	7:14 AM PST	12:24 PM PST	5:33 PM PST

(Times are for San Francisco, CA, and will vary slightly for other locations.)

The Planets

Mercury

The nearest planet to the Sun begins the quarter as a morning object, rising in the southeast just before dawn and already approaching Mars and Jupiter. As it drops into the Sun's glow during the first half of December, watch how close it draws to the other two planets on the mornings of December 9-11 (the closest observable gathering of three bright planets for the next 25 years). Disappearing from view by mid-month, Mercury reaches superior conjunction on January 7th and enters the evening sky, becoming visible low in the west after sunset in late January. In early February, it climbs toward brighter Venus, reaching greatest eastern elongation on February 7th, but drops back into the twilight by mid-month. The Moon's passes near this planet all take place very near the Sun on the morning of December 19th and the evenings of January 19th and February 17th.

Venus

The planet named after the Roman goddess of beauty is just emerging into the evening sky, setting about 30 minutes after sunset at the beginning of December but an hour later by month's end. By mid-January, it's easily visible in the evening twilight and by late February it is unmistakable. During this time, as seen through a telescope, it's at a gibbous phase, or slightly less than full. Venus passes Uranus (which you'll need a telescope to see) on the evenings of February 7th & 8th. The crescent Moon swings nearby for pretty pairings on the evenings of December 21st, January 20th, and February 19th.

Mars

The "Red Planet" is a morning object all quarter, rising in the east-southeast shortly before dawn, passing from the stars of Libra through those of Scorpius and Sagittarius, and then into Capricornus. Don't miss its striking grouping with Mercury and Jupiter on the mornings of December 9-11. The Moon is nearby on the mornings of December 18th, January 16th, and February 14th.

Jupiter

Our solar system's largest planet is a morning object, located against the stars of Scorpius the Scorpion, passing just north of the bright star Antares – the heart of the Scorpion – on January 6th (though, technically, it leaves the boundary of Scorpius and enters Ophiuchus at the end of December). Through the quarter, it rises earlier and is gradually seen more and more to the southwest each dawn. At the end of February, it's located due south at sunrise. On the mornings of December 9-11, look for it clustered with Mercury and Mars, all within a 1-degree circle – well within the field of view of an average pair of binoculars. The Moon passes near on the mornings of December 18th, January 15th (though closer that morning to Antares than to Jupiter), and February 12th.

Saturn

At the beginning of December, the "Ringed Planet" rises about 10 pm and is descending in the west at dawn. Located near the bright star Regulus, the heart of Leo the Lion, it reaches opposition on February 10th, rising at sunset and setting at sunrise – this means that it's visible all night long. Its magnificent rings are easily visible through a small telescope. Look for the Moon near Saturn on December 9th, January 5th, and February 2nd.

The Docents' Corner

In the fall of 2008, the Academy will move into its new "green" building in Golden Gate Park. A 212,000 gallon Coral Reef tank will be one of the highlights of the new Steinhart Aquarium.

How will the Academy create one of the largest indoor coral reefs in the world? How will scientists maintain the correct temperature, light and salinity? How will they keep the fish, corals, clams, and other animals healthy? How will they prevent predation in the fish tanks? What is a "green building," anyway?

These are a few of the questions that will be answered in the next docent training course: Pumps, Pipes, and Pods, and the Greening of the Academy.

Are you interested in the natural sciences? Become a trained docent and share your knowledge and enthusiasm for the natural world with our visitors. Training for this behind the scenes view will be offered in January 2007.

For more information about the docent program and other volunteer opportunities, contact Rosalind Henning at (415) 321-8111 or rhenning@calacademy.org.



Super-Size It. Continued from page 5.

Unfortunately, Reynolds did not own an oven large enough to hold the completed window, so they had to build a special oven in their parking lot to accommodate the panel. This temporary oven was a whopping 60 feet long, 25 feet wide and 16 feet tall. By the time it made the journey to San Francisco, the window had baked for nearly 30 days.

The final step in the window production process is polishing, which is normally done by a machine. However, because almost all of the Academy's acrylic windows are curved, they had to be polished by hand—a process that takes a great deal of teamwork and artistry. All of the sanding must be done under a constant stream of water so the surface of the acrylic does not get too warm, and sanders working on separate sections of the panel must be sure to remove equal amounts of surface material.

All five of the acrylic viewing panels have now been installed in the Coral Reef tank and sealed into place with watertight silicon. Soon, the tank will be water tested for the first time, activating the Xypex and completing the waterproofing process. A new home is ready and waiting for the sharks, rays, fishes, corals, and turtles that will fill the display in 2008.

ACADEMY TRAVEL PROGRAM

The mission of the Travel Program is to offer Academy-led tours that place members in the context of specifically chosen natural environments. Teaching, understanding, and conservation are our goals.

TRINIDAD: Undiscovered Gem of the Caribbean

February 11-17, 2007

Leader: Tom Daniel



At the southernmost tip of the West Indies, cosmopolitan Trinidad bustles with life – not only in its vibrant capital city, Port-of-Spain, but in its tropical forests and savannas, too. With some 700 varieties of orchids and 400 species of birds, Trinidad has been dubbed “the Rainbow Country” by Bishop Desmond Tutu. Discover the best of this island nation with six nights at the renowned Asa Wright Nature Center, one of the world’s best birding lodges, situated in a verdant valley at 1,200 feet. Once known for coffee, cocoa, and citrus cultivation, the plantation is now covered in lush vines and a host of epiphytes, creating the effect of being deep in a rainforest. The lodge is a convenient base from which to explore the surrounding habitats, which include swamps, freshwater and saltwater marshes, and lowland and montane rainforests.

Cost: \$2,995/person, based on double occupancy, plus airfare

EXPLORING ALASKA’S COASTAL WILDERNESS

(with optional extension to Denali National Park)

Aboard *Sea Bird*

June 17-24, 2007

Leaders: Dave and Bev Kavanaugh



Where can you wake to the cry of a soaring eagle, watch tons of ice thunder from the face of a glacier, walk in a spruce forest, and observe lunge-feeding whales – while cruising in complete comfort aboard a nimble expedition ship? In Southeast Alaska, a land of fjords and islands, channels and rivers, where heavy glaciers glide toward the sea. This impossibly pristine land invites you to make landfall in its small coves and inlets. Walk forest trails to cascading waterfalls, birdwatch, and identify wildflowers in the company of experienced naturalists. Zodiacs and sturdy sea kayaks give you an opportunity to encounter Alaska intimately: behold icebergs at eye level, hear the distinctive sounds of wilderness, or savor a golden silence.

Cost: from \$4,840/person, based on double occupancy, plus airfare

For brochures or additional information, please contact the Academy Travel Office
Phone 415.901.8129 or 800.853.9372 E-mail: calacademy@hcaptravel.com

Academy Lectures

Location: Sequoia Boardroom, California Academy of Sciences

Tickets: Free for Academy members, \$8 non-members. Purchase tickets by calling (415) 321-8000, visiting calacademy.org, or at the door, when available.

Jurassic Marine Park:

Paleontology in the Western United States

Carol Tang, Ph.D.

Associate Director of Public Programs, California Academy of Sciences

Tuesday, December 5, 2:00 pm & 7:30 pm

While dinosaurs roamed the continents, the oceans covering the western United States teemed with marine life. The Jurassic was a time of great upheaval in the oceans with seaways opening and closing, unusual water chemistry, and unique sea floor sediments. For marine ecosystems, a "marine revolution" was brewing with a dramatic increase in species diversity, and organisms exploiting new habitats and new food sources. Join Tang for an exciting look at this prehistoric marine world.



Drifting Continents and Globe-trotting Dinosaurs

Scott D. Sampson, Ph.D.

Chief Curator of Vertebrate Paleontology, Utah Museum of Natural History

Tuesday, January 16, 2:00 pm & 7:30 pm

A number of paleontological expeditions to the island of Madagascar over the past decade have resulted in spectacular and significant discoveries of dinosaurs and other back-boned animals that date to the late Cretaceous, about 70 million years ago. Along with a bizarre assortment of carnivorous and herbivorous dinosaurs, these fossil finds include an array of fishes, frogs, lizards, snakes, crocodiles, birds, and mammals. These ancient remains have proven to be pivotal in elucidating issues surrounding fragmentation of the southern supercontinent Gondwana. Join Sampson, on-air host of a four-part documentary series on the Discovery Channel called *Dinosaur Planet*, as he delves into the marvelous dance of continental movements and biological evolution that we are only now beginning to unravel.



Not in Our Classrooms: Why Intelligent Design Is Wrong for Our Schools

Eugenie Scott, Ph.D. & Glenn Branch

Executive Director and Deputy Director at the National Center for Science Education

Tuesday, February 20, 2:00 pm & 7:30 pm

In the wake of the Kansas Board of Education's 2005 approval of state science standards that cast doubt on the theory of evolution, and intelligent design's defeat in the high-profile *Kitzmiller v. Dover* case in Dover, Pennsylvania, the debate over evolution education and the teaching of "creation science" continues in countless school districts across the United States. In their book, Scott and Branch have gathered experts and activists from the scientific, legal, religious and education communities to give educators, parents and other concerned citizens the information and tools they need to successfully fight against the teaching of intelligent design in science classrooms. Book signing to follow lecture.



Special Lecture at
the JCC on page 7

CONVERSATIONS AT THE HERBST THEATRE 2007

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All Programs at the Herbst Theatre, 8 pm

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The California Academy of Sciences does not
process ticket orders for these lectures.

Tuesday, January 23

Steve Wozniak

Co-founder of Apple Computers
iWoz: From Computer Geek to Cult Icon
How I Invented the Personal Computer,
Co-Founded Apple, and Had Fun Doing It
In conversation with Roy Eisenhardt

Monday, April 30

Sherwin Nuland

Author, Professor of Surgery at
Yale University
How We Live, A Doctor's Plague,
Leonardo da Vinci

Tuesday, May 8

Michael Pollan

Science Writer
The Omnivore's Dilemma,
The Botany of Desire

Marion Nestle

Author, Professor of Public Health,
New York University
What We Eat, Food Politics, Safe Food

Wednesday, June 6

Zahi Hawass

Secretary General of Supreme Council of
Antiquities, Egypt
Egyptologist, Archaeologist
Secrets of the Sphinx,
Hidden Treasures of Ancient Egypt

Summer Systematics Institute

*Academy research program
for undergraduates
wraps up its
12th year*



*Courtney Mattison displays a preserved gorgonian coral.
This summer she researched the symbiosis between corals and barnacles.*

With a pencil and a steady hand, Chris Laumer carefully marks 17 points on a clam shell the size of a dime. To the outsider, these points are completely arbitrary; to Chris, they contain a wealth of evolutionary data, accessible only through complex mathematics. “At the start of the summer, we were told that we’d be the best in the world at something,” he says. “I am the best in the world at finding these 17 points on the shell.”

Chris is one of nine undergraduates participating in the 2006 Summer Systematics Institute (SSI) at the Academy. Now in its 12th year, SSI provides students with the opportunity to conduct independent research based on the museum’s collections, with the guidance of an Academy scientist. For many, this intense eight-week internship offers both personal and academic adventures.

Chris, for example, is visiting the West Coast for the first time. He took a 90-hour train ride from Philadelphia so that he could see the Rocky Mountains on his way to San Francisco. This summer represents his first significant research experience. And his project, which involves an esoteric branch of biology called morphometrics, is completely new to him.

But halfway through the program, he’s already hit his stride. He speaks with his mentor, Dr. Peter Roopnarine, for an hour every day about “non-Euclidean n-dimensional space”; he leafs through a tome entitled *Programming in C* when not examining clams; he’s even made a contact through Roopnarine for a potential graduate adviser.



Above: Nicole Cox measures the pedicellariae (ice tong-like defensive pincers) on an Atlantic sea urchin.

"The distinction between free time and work is starting to dissolve," he says, "because I enjoy what I'm doing so much."

The first Summer Systematics Institute was held in 1995, organized by then Director of Research Dr. Patrick Kociolek as an Academy-funded pilot project. Today, the program is supported by the National Science Foundation and Robert T. Wallace Foundation, with an additional internship in biological illustration funded by the Academy Fellows. Funding goes toward a generous stipend as well as living expenses for the students.

Dr. Rich Mooi, one of the Academy's curators of invertebrate zoology and geology, has overseen the SSI for the past eleven years. To keep the program running smoothly, he coordinates everything from grant applications and scheduling to identifying prospective mentors and reviewing student applications.

"We look for those who might not normally get research experience in their home institutions, as well as groups underrepresented in the sciences," says Mooi. "However, that doesn't mean that others won't be accepted. The most important criterion is a fit between adviser and applicant, usually a combination of academic excellence and an interest in whole organism biology."

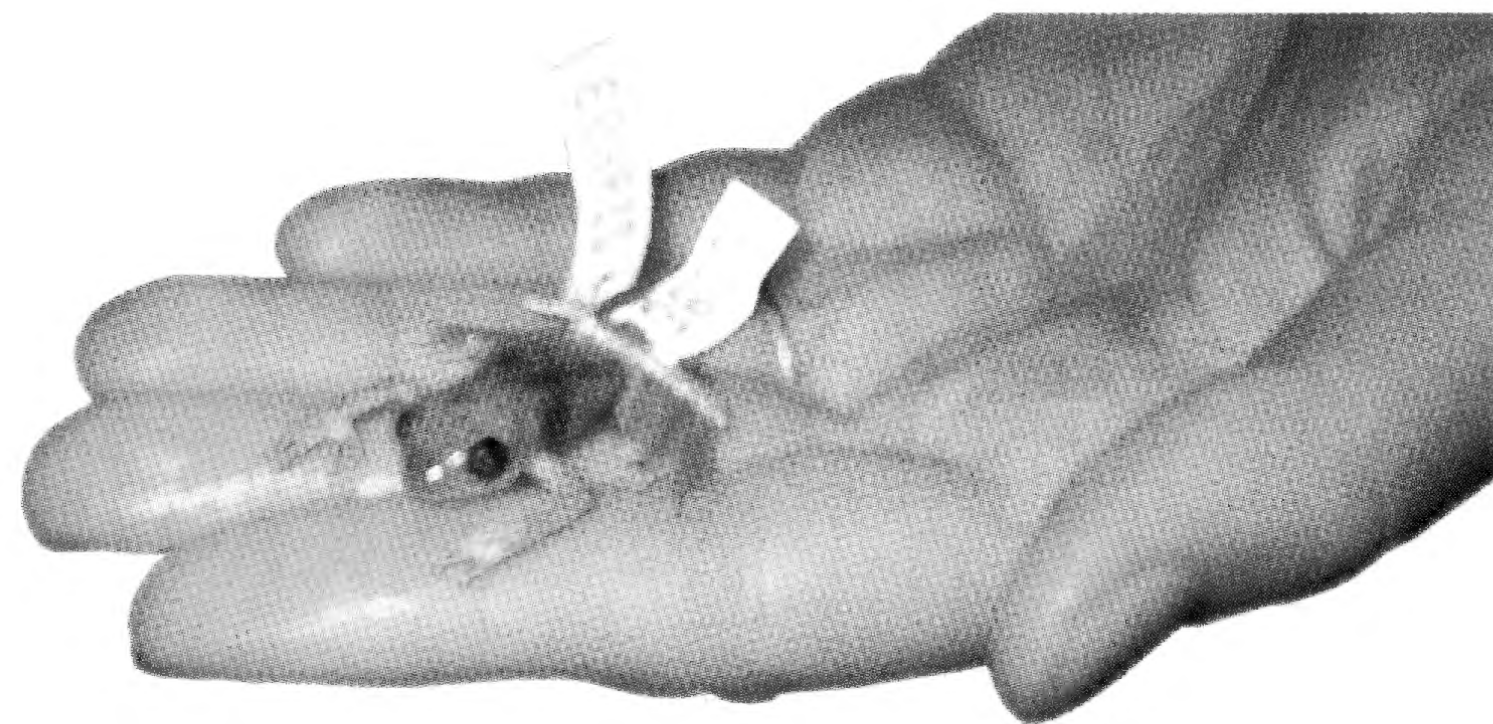
Competition for the coveted few spots has intensified since the program's inception—though it used to average 50 applicants per year, the number of applicants this year surged to 106, a record high. The applicant pool is diverse in terms of race, gender, prior research experience, size of undergraduate

institution, and geography. Students from North Carolina to San Francisco, from small liberal arts colleges to massive state universities, all vie for spots.

Once the selected interns arrive at the Academy, more than just research awaits them. They also attend daily workshops, seminars, and lectures presented by Academy scientists, covering such topics as molecular systematics, collections management, and how to give effective presentations. And while the summer culminates in a day-long series of research presentations, that is by no means the end of their experience. Interns often return to finish projects, attend national meetings with their mentors, publish papers, and—in some cases—go on Academy expeditions related to their work.

One of the most important aspects of SSI is its role as a stepping stone to graduate school. Mooi knows of at least 30 former interns who have gone on to Master's or Ph.D. programs in the sciences. Inspiring students to pursue graduate programs, especially those focused on systematics, is a responsibility that the Academy takes seriously. Although the National Science Foundation funds 140 biological internship programs annually, only five involve systematics-based research institutions like the Academy.

"In this day and age, it's never been more important to understand biodiversity, because much of it is disappearing," says Mooi. "Sending out the next generation of scientists is a critical task. If we don't do it, who will?"



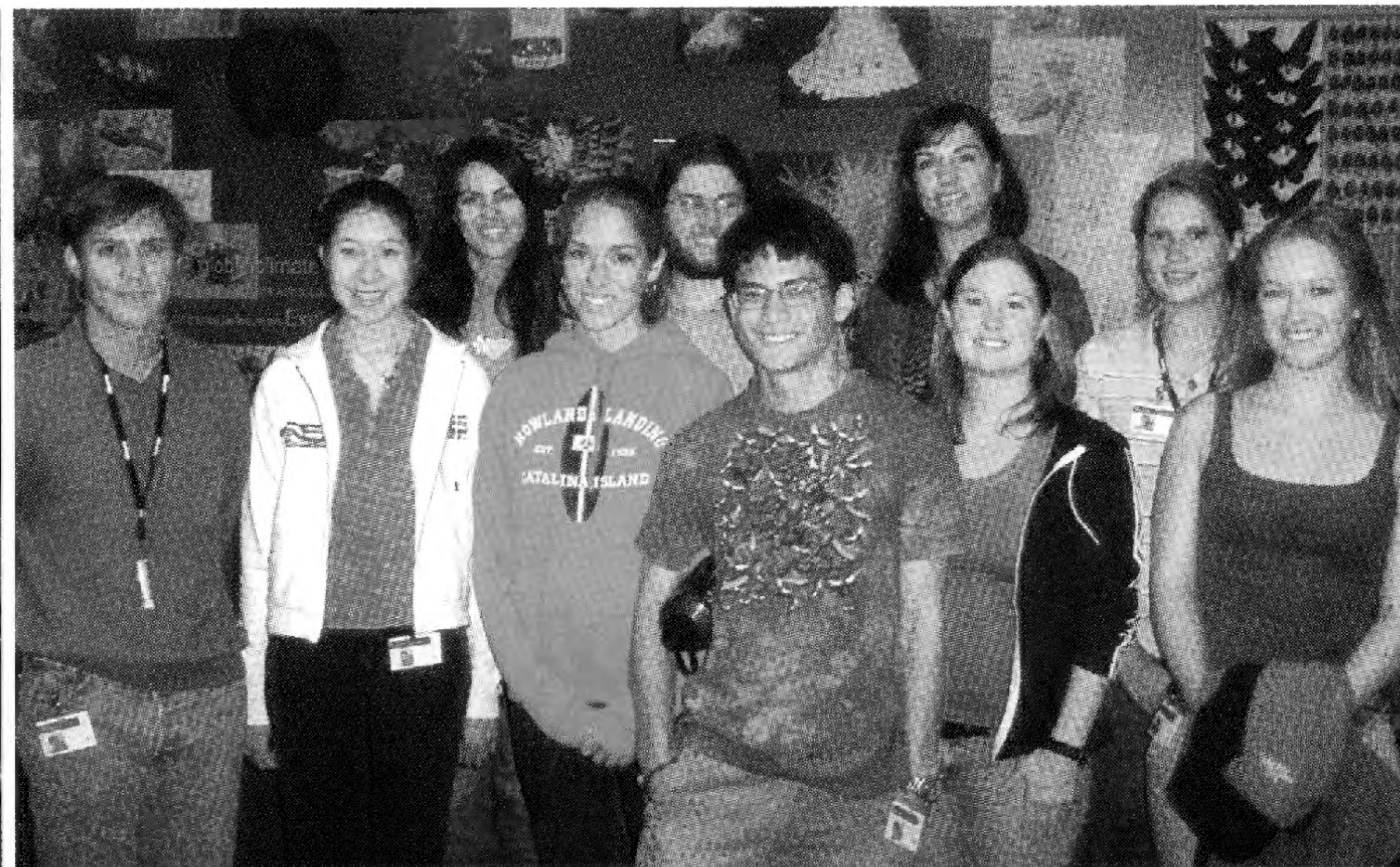
Katie Marshall holds a frog from Sao Tome and Principe. She is investigating whether or not the frog populations on the islands have evolved into different species.

Down the hall from Chris and his clams, intern Carmen deLeon is squeezing the last drop of *Plasmodium* DNA into an agarose gel. *Plasmodium* is the parasite that causes avian malaria; Carmen is investigating whether it is infecting California's spotted owl population.

Although Carmen has studied birds before, she never thought about devoting her career to ornithology until this summer. "SSI makes me feel more secure in my decision to pursue scientific research," she says. "I now know the lab techniques to make a difference—I don't think I've ever learned this much in this amount of time."

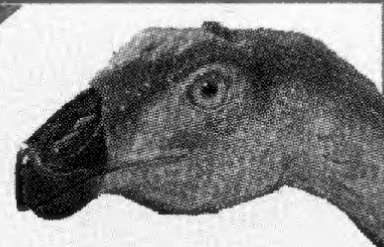
Besides gel electrophoresis, her new skills include extracting DNA, aligning sequences, and creating phylogenetic trees. With this powerful molecular arsenal, she says she's ready to face the rigors and joys of a scientific career.

"You have the passion in you," she says, while waiting for the results of her experiment. "You just need the right opportunities."



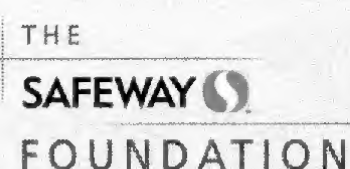
Left: Jason Koontz examines the radula of a tropical sea slug, magnified several thousand times by a scanning electron microscope. Center: The 2006 SSI interns hail from seven different states. Right: Erin Hunter, the biological illustration intern, pays close attention to detail. "Sometimes my adviser will tell me to draw the hairs on a flower stem three millimeters longer," she says.

UPCOMING SPECIAL EVENTS



The Academy is delighted to present the special exhibit, *DINOSAURS: Ancient Fossils, New Discoveries* (September 16, 2006 – February 4, 2007). Please join us to learn more about these exciting creatures!

In San Francisco, sponsorship for the exhibit is generously provided by:



Charles R. Schwab
Charles Schwab Foundation

Every Friday through February 2, 2007
SPECIAL EXHIBIT HOURS FOR MEMBERS

Members are invited to visit the Academy at 9:30 am before it opens to the public at 10:00 am. Don't forget, members receive free admission every day during regular visiting hours.

Various days and times,
Through February 4, 2007
SPECIAL MORNING TOURS FOR FRIENDS OF THE ACADEMY

Friends of the Academy are invited to join special morning tours of *DINOSAURS: Ancient Fossils, New Discoveries* with Academy exhibit curators. For more information and for the schedule of morning tours, contact Jeanna Yoo at 415.321.8413 or jyoo@calacademy.org.

December 15, 16 and 17, 11:00 am–5:00 pm
MEMBERS' DISCOUNT SHOPPING DAYS

Stop by the Academy Store for your holiday shopping and receive a 20% discount on all purchases. Simply present your membership card when you make your purchase. Happy shopping!



February 3, 8:30–10:30 am
GUILD BREAKFAST WITH THE DINOSAURS

Academy Guild members are invited to a special family event before the exhibit closes. Go on a "dino dig" and enjoy other dinosaur related activities. For more information contact Jeanna Yoo at 415.321.8413 or jyoo@calacademy.org

CHILDREN'S BIRTHDAY PARTIES

Have your child's party at the Academy. The decorative second floor classroom is available for children's birthday parties on Saturdays and Sundays. Choose from an Aquarium or Dinosaur themed party that includes related take-home crafts and a guided tour. Children's birthday parties are open to members only. Book early as party spaces fill up fast. For more information, contact Centralized Reservations at 415.321.8000 or email birthday@calacademy.org.

THANK YOU

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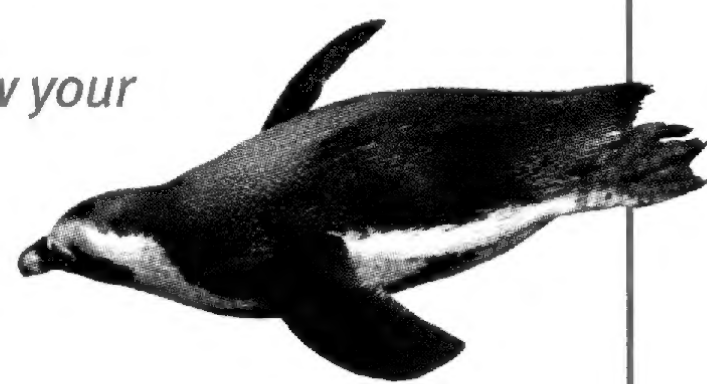
Friends of the Academy



Trustee Carmen Policy, Gail Policy, Associate Executive Director Chris Andrews, and Diana and Terry Nelson enjoy the Friends Preview Reception for the *DINOSAURS* exhibit.

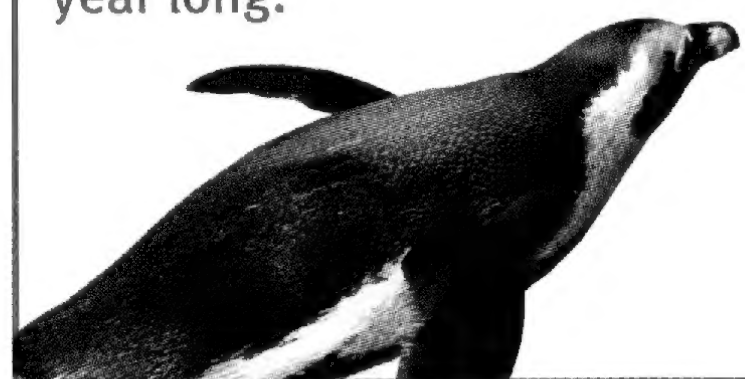
To learn about the donor benefits for Friends or to join, contact Jeanna Yoo at 415.321.8413 or jyoo@calacademy.org. Also, visit us online at www.calacademy.org/friends

RENEW NOW! We invite you to renew your membership now for two years at a special family rate – \$100, a savings of \$20 – and join us at the opening events for the Academy's return to Golden Gate Park.



Gift Memberships for the Holiday Season

A membership to the Academy is a perfect gift for family and friends. They'll thank you for it all year! Purchase by December 17 to ensure it will arrive for the holidays. Gift memberships are available all year long.



Membership questions? Contact us: 415.321.8000, toll free 800.794.7576 Monday-Friday, 8:00 am to 5:00 pm or membership@calacademy.org.

Dynamite DinoNight!

Presented by the Academy Guild

On October 27, more than 500 children and adults enjoyed a haunted house, puppet shows, scavenger hunts, live animals, scientists with hair-raising specimens, and a delicious dinner during the Academy's 15th Annual Halloween Party.



Co-chairs Lucy Hume Koukopoulos and Shannon Davis remarked, "We had such a great time! We were all in costume and got to roam throughout the *DINOSAURS* exhibit and the Academy while enjoying fun activities for all ages. It is definitely one of our favorite family events, not to mention an annual tradition."

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CORAL REEF Carnival

SAVE THE DATE

22nd Annual Academy Ball Thursday, May 10, 2007

San Francisco, City Hall, 7:00 pm to midnight

For more information, contact Deidre Kernan at 415.272.4328 or dkernan@calacademy.org.

For sponsorship opportunities, contact Rebecca Schuett at 415.321.8234 or rschuett@calacademy.org.

EASTWOOD TRADITION

Mike Marron, Eastwood Associate



"We enjoy contemplating our ancestry," said Mike Marron.

Sharon and I have been Academy members for many years and as parents enjoyed introducing another generation to the museum's marvels. The focal point of any visit was the gorilla in African Hall. His fierce visage and indomitable presence, unchanged over the years, were a welcome reassurance that some familiar, beloved things remain the same. Because of our love for the Academy, we included it in our estate plans but never thought to tell anyone until we learned about the Eastwood Associates. Now, we are invited to programs that have given us a better understanding of the Academy's work – how it advances scientific research and educates so many in our

community. We really feel part of the Academy and are proud that our bequest will make a difference to its future.

Let the Academy staff know when you have included the museum in your plans or are considering doing so. The Academy would like to invite you to a very special February reception in honor of the Eastwood Associates, the special association of members and volunteers who have included the Academy in their estate plans.

For information about Eastwood Associates, please contact Louise Gregory at 415.321.8407 or lgregory@calacademy.org.



Above: In September, contractors installed the curved roof steel over the planetarium dome. These beams will eventually support soil and native California plants that weigh over 2.6 million pounds.

Top Right: A film crew from the Discovery Channel spent almost 30 days at the site between July and September documenting the construction progress for an episode of "Extreme Engineering." The show will begin airing this winter.

Bottom Right: The meandering ramp that will carry visitors through the Rainforests of the World exhibit is now installed. A rollercoaster manufacturer was hired to bend the steel for this curvy ramp.



On any given day, anywhere from 200 to 550 carpenters, welders, engineers, and other specialists are hard at work at the new Academy construction site. Over the past several months, three of those specialists have had a rather unique job—capturing the construction progress on film for an upcoming episode of the popular Discovery Channel show "Extreme Engineering." The film crew has recorded a number of the most complicated components of the building construction process, including the installation of the steel skeleton for the planetarium dome and the installation of the undulating roof steel.

The steel roof beams that stretch across the planetarium dome must span a distance of nearly 100 feet without the support of structural columns. The heaviest of these beams weighs over 18,000 pounds and was shipped to the site in two pieces because of its length. The steel is so thick that it took an entire day to weld the two sections together before they could be flown into place by crane. These heavy roof steel beams will be supported with temporary shoring until the steeply sloped concrete roof deck is poured. Only after the deck has dried will the roof steel be able to support itself without shoring.

Contractors have also begun to install the steel framing around the Piazza, the central courtyard in the new Academy building. The open-air Piazza will include rain screens that can be pulled across the open section of the roof in wet weather. The steel that will support this complicated screen must be able to withstand anywhere from 20,000 to 80,000 pounds of pressure, so the beams are reinforced with diagonal struts.

Eventually, the hills formed by the rolling roof steel beams will be blanketed with six inches of soil and planted with nine species of native California plants.

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